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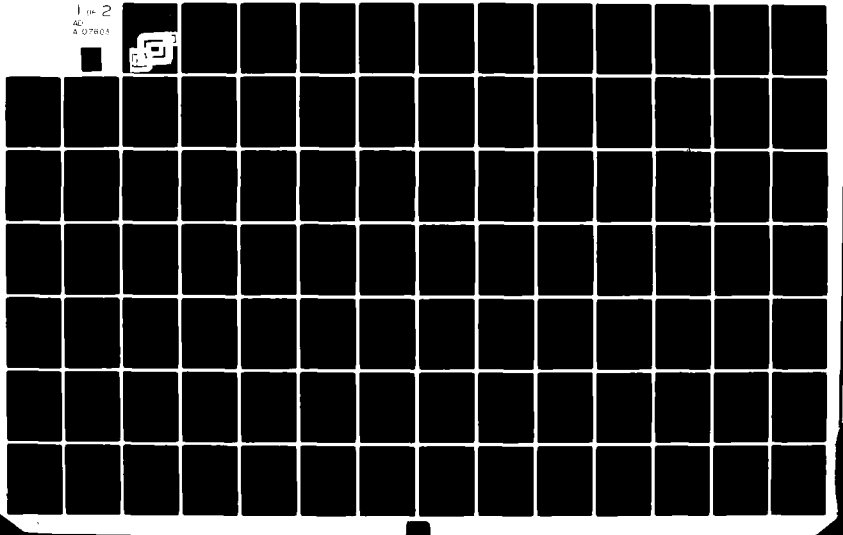

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November 1981

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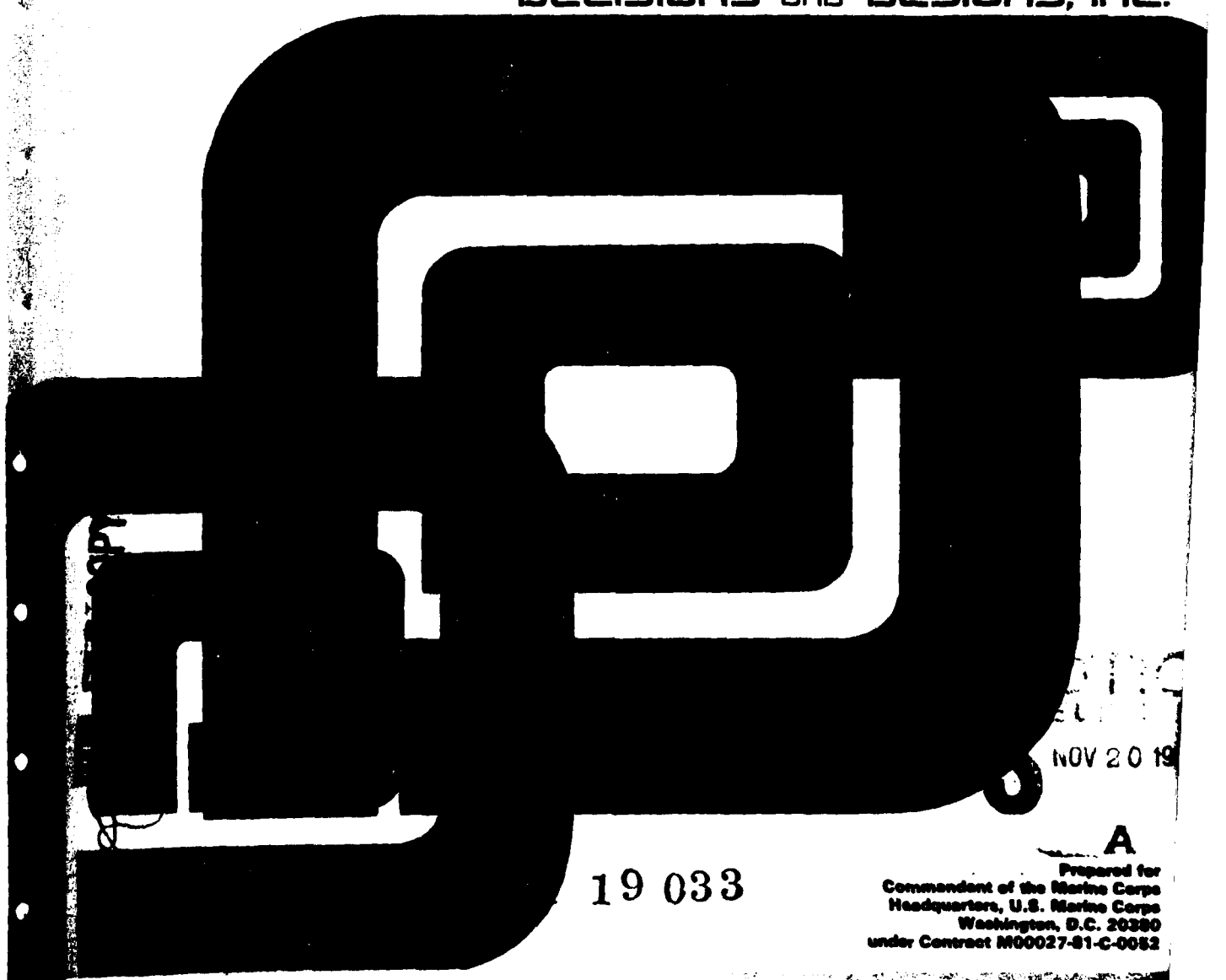
Training Requirements and Cost Evaluation System (TRACES) for Marine Air Command and Control: Phase I

John F. Patterson
Leonard Adelman

DECISIONS and DESIGNS, INC.



Prepared for
Commandant of the Marine Corps
Headquarters, U.S. Marine Corps
Washington, D.C. 20380
under Contract M00027-81-C-0052

INTERIM REPORT PR 81-26-329

TRAINING REQUIREMENTS AND COST EVALUATION SYSTEM (TRACES) FOR MARINE AIR COMMAND AND CONTROL: PHASE I

by

John F. Patterson and Leonard Adelman

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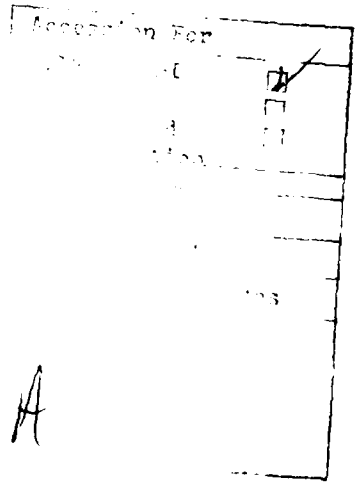
20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

The U.S. Marine Corps is in the process of developing a service-wide system for cost-effective allocation of training effort to ensure the combat readiness of its forces. This system is called TRACES (Training Requirements and Cost Evaluation System). As part of TRACES' development, Decisions and Designs, Inc. (DDI) is assisting the Marine Corps in developing a computer-based system for cost-effective allocation of training effort to units in

the Marine Air Command and Control System (MACCS). A unit's training is to be assessed by its Marine Corps Combat Readiness Evaluation System (MCCRES) scores.

In 1979-1980, DDI assisted the Marine Corps in constructing a prototype benefit-cost TRACES model and accompanying computer software for infantry battalions. In the first phase of the current contract, DDI and Marine Corps personnel have determined the extent to which the benefit-cost approach used for infantry battalions would be applicable for the MACCS. The training options and readiness returns have had to be modified considerably in order to reflect basic differences in the training evolutions (and roles) of infantry battalions and the MACCS. Nevertheless, the benefit-cost approach used to implement TRACES with infantry battalions has been successfully extended to the MACCS.

Among the recommendations offered to the Marine Corps were the suggestions to develop a MCCRESS data base system which would be used to store, record, and analyze MCCRES evaluations, and to continue TRACES development for its ultimate applicability to the entire Marine Air Ground Task Force (MAGTF).



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TRAINING REQUIREMENTS AND COST EVALUATION SYSTEM (TRACES) FOR MARINE AIR COMMAND AND CONTROL: PHASE I

1.0 INTRODUCTION

The U.S. Marine Corps is in the process of developing a service-wide system for cost-effective allocation of training effort to ensure the combat readiness of its forces. This system is called TRACES, for Training Requirements and Cost Evaluation System. As part of TRACES' development, the Marine Corps is developing a computer-based system for cost-effective allocation of training effort to units in the Marine Air Command and Control System (MACCS). A unit's training is to be assessed by its Marine Corps Combat Readiness Evaluation System (MCCRES) scores.

Decisions and Designs, Inc. (DDI) has been tasked to assist the Marine Corps in developing a computer-based system for cost-effective allocation of training for the MACCS. DDI has considerable experience in developing computer-based systems to assist the Marine Corps. Through funding provided by the Defense Advanced Research Projects Agency (DARPA), in 1976-1977, DDI assisted the Marine Corps in developing the prototype multi-attribute utility assessment model and scoring system used in MCCRES. In 1979-1980, through funding again provided by DARPA, DDI assisted the Marine Corps in constructing a prototype benefit-cost TRACES model and accompanying computer software for infantry battalions.

In the first phase of the present contract, DDI analysts were tasked to work with Marine Corps personnel to determine the extent to which the benefit-cost approach used for infantry

battalions would be applicable for the MACCS. This first phase has been completed successfully; the general benefit-cost approach used for infantry battalions is directly applicable to the MACCS. The training options were modified considerably, however, to reflect basic differences between infantry battalion and MACCS training.

The training evolution of infantry battalions is predominantly based on a specific unit's deficiencies; a battalion uses MCCRES to identify areas of weak performance and then trains on those areas. Consequently, the computer software developed for infantry battalions emphasizes training options that can be scheduled by the battalions. Using the battalion's MCCRES scores as inputs, the software identifies the training option (a two- or three-day field exercise) that provides the most benefit (i.e., combat readiness return) for specific levels of cost.

The training evolution of the MACCS differs from that of the infantry in two respects. First, the MACCS functions as a support organization within the Marine Corps. It does not initiate an exercise, but is required to support scheduled exercises. Some latitude is available for determining which components of the MACCS should participate, whether or not they will be deployed, and what scenarios should be incorporated into an exercise; but, the MACCS does not typically control the choice of when and where to hold an exercise.

The second difference between the MACCS and infantry training is that the MACCS is a system. It does not schedule specific MCCRES evaluations directed towards identifying problems within a specific MACCS. Instead, MACCS/MCCRES evaluations are conducted in conjunction with major exercises.

They can only collect data on those tasks that are incorporated into an exercise. Moreover, they involve units that are together for the specific exercise, but which may or may not be together on the next exercise. Thus, the cycle of evaluate-train-evaluate within an infantry battalion is more difficult for the MACCS.

The MACCS approach to TRACES views MCCRES' evaluations as indicative of Marine Corps-wide deficiencies. In other words, no single MACCS/MCCRES evaluation is taken as a complete indicator of MACCS performance. Instead, the MACCS readiness benefits are formulated by aggregating MCCRES evaluations.

This emphasis on Marine Corps-wide readiness and the use of aggregated MCCRES scores implies that the MACCS' TRACES will also differ from the earlier infantry TRACES by being a major headquarters tool, rather than oriented towards a specific unit. First, a proper aggregation of the MCCRES evaluations is required by TRACES and can best be provided at a headquarters level. Second, the headquarters is the appropriate level for advocacy in favor of training options. In addition, units that provide a support role, such as those in the MACCS, require advocacy at that level. Finally, the costs of the training options represented in TRACES are committed at the headquarters level.

In summary, the training options and readiness returns have had to be modified considerably in order to reflect basic differences in the training evolutions (and roles) of infantry battalions and the MACCS. Nevertheless, the benefit-cost approach used to implement TRACES with infantry battalions has been successfully extended to the MACCS. Furthermore, DDI concludes that the computer software necessary to implement TRACES for the MACCS can be developed for the dollar amount

proposed for Phase II of the contract. Also, it is further recommended that the software in Phase II be developed. The result will be a computer-based system for assessing the readiness return and accompanying costs obtained from the various MACCS training cycles.

The remainder of this report is divided into five parts. Section 2.0 provides an illustrative example showing how the Marine Corps will be able to use TRACES to identify the best training allocations for the MACCS. In Section 3.0 the technical approach for benefit-cost analysis is described. Section 4.0 outlines the options that will be available to Marine Corps personnel for the use of TRACES. System support implications for TRACES are discussed in Section 5.0. And, Section 6.0 presents conclusions and general recommendations.

2.0 USING TRACES TO IDENTIFY COST-EFFECTIVE DEPLOYMENT CONFIGURATIONS FOR FIELD EXERCISE WITH A MARINE AMPHIBIOUS FORCE: AN ILLUSTRATIVE EXAMPLE

The purpose of this example is to show how to use TRACES to select the deployment configuration for MACCS agencies that provides the most combat readiness return for specific levels of cost. The field exercise with a Marine Amphibious Force (MAF) was selected as the example because it represents the largest and most complex MACCS training option. TRACES will be capable of identifying the most cost-beneficial MACCS deployment configurations for ten other major training events.

The basic decision facing the MACCS personnel who are supporting a field exercise with a MAF is how to deploy the six agencies within the MACCS so they receive the highest combat readiness return for a specific level of cost. This decision problem is represented in Table 2-1. The six rows represent the six agencies in the MACCS and the columns represent the possible deployment configurations for these agencies. For example, the MACCS personnel could select (1) a nondeployed or deployed Tactical Air Command Center (TACC), (2) a nondeployed, an Early-Warning, or a deployed Tactical Air Operations Center (TAOC), (3) a full Direct Air Support Center (DASC) or a full plus a mini-DASC, (4) up to three batteries of Light Anti-Aircraft Missile (LAAM), (5) up to three Air Support Radar Teams (ASRTs), and, (6) up to two platoons of Forward Area Air Defense (FAAD) with ordnance. The MACCS chosen to support the field exercise with the MAF will be defined by the one deployment configuration selected for each of the six agencies.

AGENCIES	DEPLOYMENT CONFIGURATIONS							
	1	2	3	4	5	7	8	9
TACC	Non-Deployed	Deployed						
TAOC	Non-Deployed	Early Warning	Deployed					
DASC	Full	Full + Mini						
LAAM	None	1 BTRY	2 BTRY	3 BTRY				
ASRT	None	1 ASRT No Ordnance	1 ASRT Ordnance	2 ASRT No Ordnance	2 ASRT Ordnance	3 ASRT No Ordnance	3 ASRT Ordnance	
FAAD	None	1 PLATOON No Ordnance	1 PLATOON Dummy Ordnance	2 PLATOONS No Ordnance	2 PLATOONS Dummy Ordnance			

Table 2-1

MACCS DEPLOYMENT CONFIGURATION CHOICES FOR FIELD EXERCISE WITH A MAF

Each successive deployment configuration within each agency will provide more training benefit, but for increased cost. The problem is knowing which deployment configuration of the agencies will provide the most cost-effective training for the MACCS overall. Considering the present example, there are 1,120 (2x2x2x4x7x5) possible deployment configurations for a MACCS supporting an integrated field exercise with a MAF. This situation is depicted in Figure 2-1. Each dot represents a different deployment configuration in the benefit-cost space. The set of dots tends to form a lozenge-shaped region bounded above by what is called, "the efficient frontier". The MACCS deployment configurations on this frontier are the most cost-beneficial configurations because they provide the most benefit (i.e., combat readiness return to the MACCS) for a given level of cost. Consequently, MACCS personnel should select one of these configurations in order to solve their decision problem.

MACCS personnel will be able to use TRACES to solve their decision problem in one of two ways. First, they will be able to identify the deployment configuration that provides the most combat readiness return to the MACCS for a specified cost. Second, they will be able to identify the deployment configuration that provides a specified combat-readiness return for the least amount of money. These two capabilities are illustrated in Figure 2-2. The efficient curve for field exercise with a MAF is shown at the top of the figure; two selected deployment configurations are shown below the curve. For example, assume that MACCS personnel wanted to see the best deployment configuration for $141,000. After the appropriate inputs, TRACES would indicate that, based on assessments made by MACCS personnel (discussed in Section 3.2 of this report), this would be a nondeployed TACC, a nondeployed TAOC, a full DASC, one Battery of LAAM, two ASRTs with

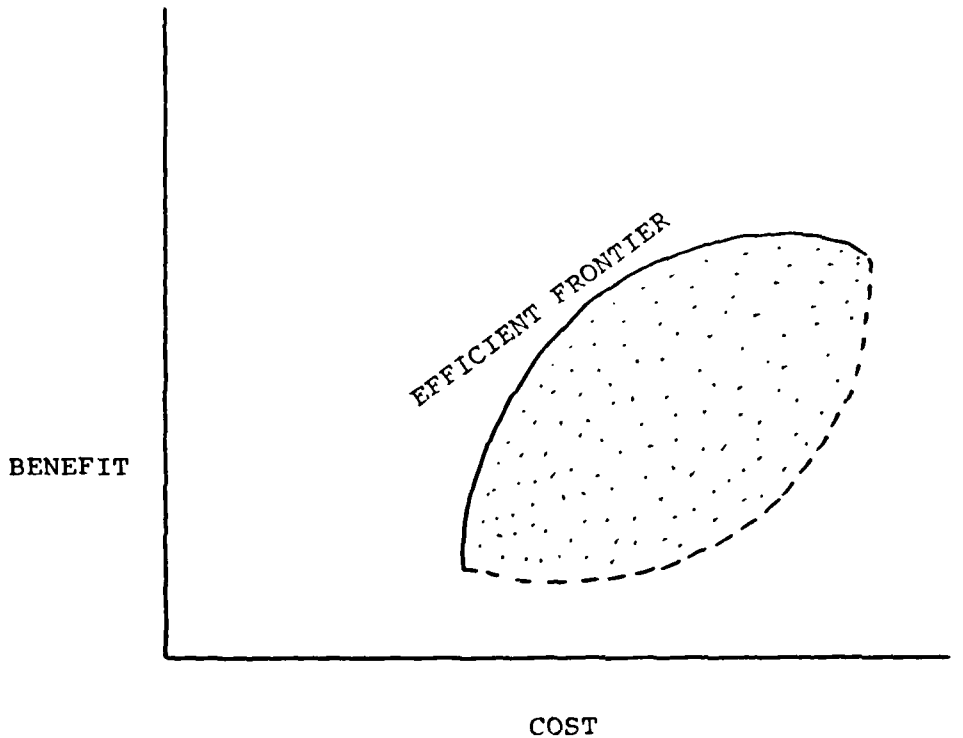
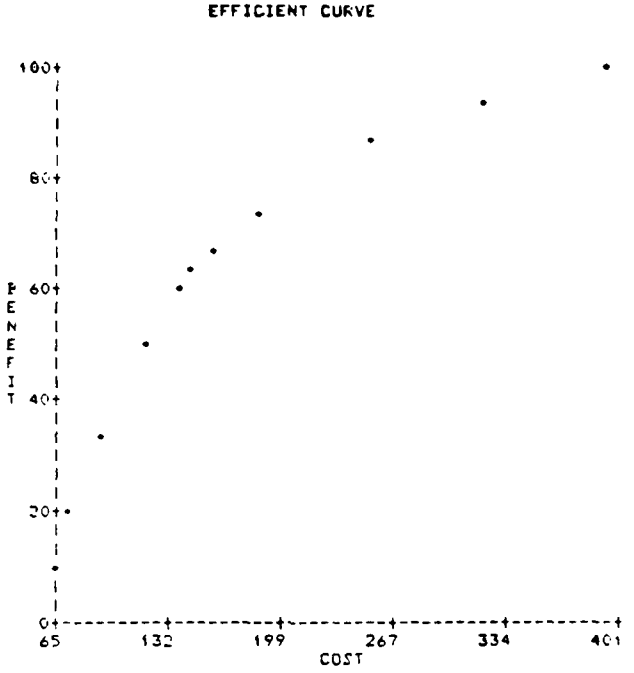


Figure 2-1

BENEFIT-COST REPRESENTATION OF POSSIBLE DEPLOYMENT CONFIGURATIONS



PACKAGE FOR C= 141

SELECTED PACKAGE

	VARIABLE	BENEFIT(%)	COST($K)	LEVEL	
1	TACC	0	10	NONDEPLOYED	(1 OF 2)
2	TAOC	112	15	NONDEPLOYED	(1 OF 3)
3	DASC	0	40	DASC	(1 OF 2)
4	LAAM	158	20	1 BTRY	(2 OF 4)
5	ASRT	254	50	2 ASRT, ORD	(5 OF 7)
6	FAAD	74	6	1 PLT, NO ORD	(2 OF 5)

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SELECTED PACKAGE

	VARIABLE	BENEFIT(%)	COST($K)	LEVEL	
1	TACC	82	75	DEPLOYED	(2 OF 2)
2	TAOC	245	80	DEPLOYED	(3 OF 3)
3	DASC	44	55	DASC + MINI	(2 OF 2)
4	LAAM	158	20	1 BTRY	(2 OF 4)
5	ASRT	311	75	3 ASRT, ORD	(7 OF 7)
6	FAAD	93	12	2 PLT, NO ORD	(4 OF 5)

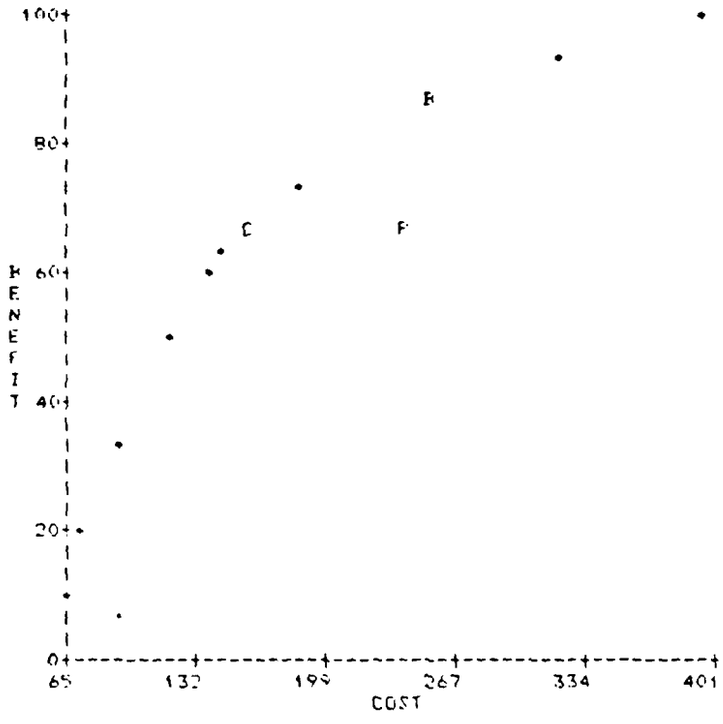
Figure 2-2

USING TRACES TO SELECT THE BEST DEPLOYMENT CONFIGURATION BASED ON COST AND ON BENEFIT

ordnance, and one platoon of FAAD. This is the MACCS deployment configuration on the efficient curve at $141,000. On the other hand, MACCS personnel might want to know which deployment configuration will guarantee at least a 90% training benefit (i.e., combat readiness return) to the MACCS for the least amount of money. TRACES would indicate that, for an integrated field exercise with a MAF, this would be a deployed TACC, a deployed TAOC, a mini- and full DASC, one LAAM battery, three ASRTs with ordnance, and two FAAD platoons with no ordnance. This is the MACCS deployment configuration that is on the efficient curve at a benefit level of 93.4%.

TRACES will have many capabilities in addition to being able to identify the best deployment configuration for a specific amount of money, and the least expensive configuration for a specific level of benefit. For example, MACCS personnel will be able to evaluate the relative cost-effectiveness of a specified deployment configuration. This capability is illustrated in Figure 2-3. The proposed deployment configuration is identified by the P. The C identifies a MACCS deployment configuration that provides the same benefit for less money, and the B, one that provides more benefit for the same cost. The table below the graph identifies the three deployment configurations. The proposed configuration contained the following:

- a deployed TACC,
- a deployed TAOC,
- a full DASC,
- 1 battery of LAAM,
- one ASRT with no ordinance, and
- one FAAD platoon with no ordinance.



VARIABLE	LEVEL 1	2	3	4	5	6	7
1 TACC	CB	F					
2 TAOC	C		FB				
3 DASC	F	CB					
4 LAAM		CFB					
5 ASRT		F			C		B
6 FAAD		F		CB			

Figure 2-3

USING TRACES TO IDENTIFY MORE COST-EFFECTIVE MACCS DEPLOYMENT CONFIGURATIONS THAN THE ONE PROPOSED

In our example, the MACCS could receive the same benefit for about $100,000 less by not deploying the TACC or TAOC and by using a mini-DASC instead of a full DASC. This sacrifice of capability is compensated by an improved capability for the ASRT and FAAD. In contrast, the MACCS could receive approximately 33% more benefit than the proposed configuration, for the same amount of money, if:

- it did not deploy the TACC
- did deploy the TAOC,
- used a mini-DASC,
- kept the one LAAM battery,
- had three ASRT with ordnance, and
- had two FAAD platoons with no ordnance.

At this point, the reader is no doubt wondering how TRACES was able to identify these cost-effective deployment configurations for supporting field exercise with a MAF. The answer will become clear in the Technical Approach section (Section 3.0). Suffice it to say now, for a given level of money, TRACES uses benefit-cost ratios to identify deployment configurations that exercise, on a cost-effective basis, important Mission Performance Standards (MPSs) which, according to the MCCRES data, have been poorly performed by important MACCS agencies.

3.0 TECHNICAL APPROACH

This section describes the benefit-cost approach being proposed for implementation in TRACES. The section has two parts. The first part describes the conceptual framework of the training allocation system of which TRACES is a part. The second part provides a general description of the cost and relative effectiveness assessments incorporated into TRACES.

3.1 Conceptual Framework

The training allocation system for the Marine Air Command and Control System (MACCS) has two major components: (1) an explicit evaluation model that specifies how well each agency (and the MACCS overall) is performing each of its primary tasks, and (2) an explicit training model that specifies the most beneficial major training events and deployment configurations for specific levels of cost. The components can be computerized to provide immediate information about the areas of weak performance and, subsequently, the most cost-beneficial training activities. Furthermore, to ensure its utilization, the computerized system can be designed in a straightforward, user-oriented fashion that is not time-consuming to operate.

MCCRES is the evaluation component of the system. It incorporates a multi-attribute utility assessment (MAUA) model that permits the systematic assessment of a unit's combat readiness. In general, MAUA models are hierarchical in structure, starting with the specified top-level factor for which an overall evaluation score is desired. This factor is successively decomposed into subfactors, in descending levels of

the hierarchy, such that each successive level is more specific than the preceding one. The lowest level of the hierarchy contains those characteristics of the system which are readily predictable or observable. These lowest level, highly specific characteristics, are termed system elements.

Figure 3-1 presents a schematic of the MAUA model of MCCRES for the Marine Air Command and Control System (MACCS). The top-level factor is the overall combat readiness score. This factor is decomposed into an overall score for each agency in the Marine Air Command and Control System (MACCS). These scores are, in turn, decomposed into separate categories of standards that specify the appropriate mission performance standards (MPS) for the MCCRES evaluation for that agency. These standards are decomposed into specific tasks which, in turn, are decomposed into the specific requirements that represent observable activities. Thus, different activities are integrated systematically to provide evaluation scores on individual performance areas and thereby yield an overall performance score for the MACCS.

The MAUA model is used to provide an overall combat readiness score for the MACCS. First, Marine Corps evaluators rate whether the agencies did or did not satisfy each of their requirements during the MCCRES evaluation. An agency's score on each task is computed by differentially weighting the ratings on the requirements comprising that task. Consequently, an agency that failed to satisfy important requirements on a task would receive a low score on that particular task. In a similar fashion, the agency's score on each MPS is computed by differentially weighting the tasks comprising that MPS; a low score on an MPS implies that the agency performed poorly on important tasks within that MPS. The MPSs are differentially weighted to provide a score on the standards

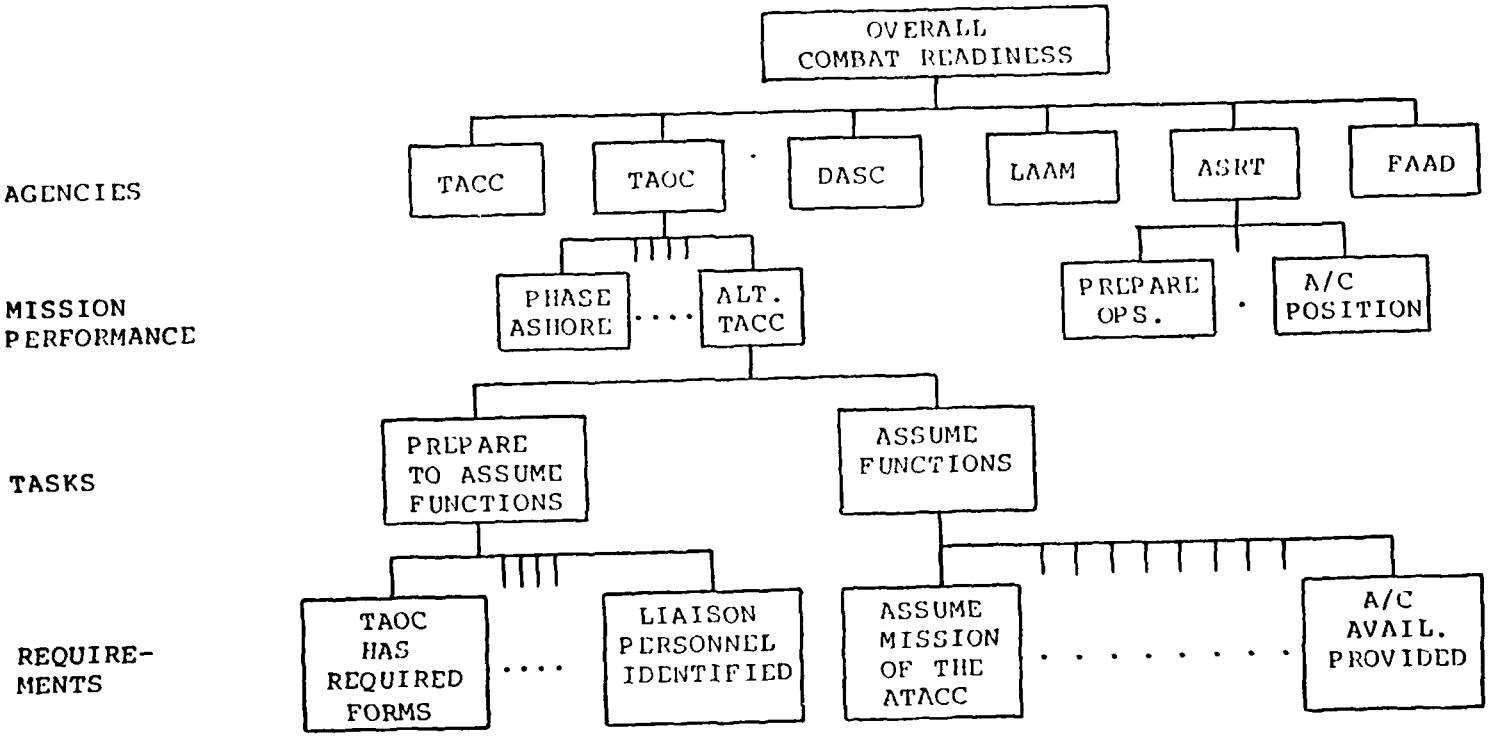


Figure 3-1

SCHEMATIC MAUA MODEL OF MCCRES FOR MARINE AIR COMMAND AND CONTROL

which, in turn, are differentially weighted to provide an overall combat readiness score for the agency. The more combat-ready the agency, the higher the overall score produced by the MCCRES evaluation. Poor overall performance can be readily attributed to poor performance on specific performance standards, tasks, and requirements. Finally, the agency's scores are differentially weighted to provide an overall combat readiness score for the MACCS.

TRACES is the training component of the system. The inputs to TRACES will be the MCCRES scores. These scores can be those of a single MACCS or, as is more likely, those of the entire MACCS. (Marine Corps personnel will determine overall scores by aggregating the MCCRES scores for a number of MACCS evaluations.) The outputs from TRACES will be the specification of those training exercises that provide the most combat readiness return for different levels of cost. The amount of combat readiness return will be identified for each MACCS' agency, as well as for the MACCS overall.

TRACES organizes its representation of the training options in terms of major training events and the deployment configurations they will permit. These options were selected to reflect doctrinal, actual, and potential training exercises.

The eleven major training events differ by three factors:

(1) the type of exercise (FX vs. CPX);

(2) the degree of ground involvement (aviation only, with MAU, with MAB, with MAF); and

(3) the exercise scenario (air defense only, air support only, both air defense and air support)

This last factor captures the fact that exercises, excluding air defense or emphasizing it to the exclusion of air support, have been observed.

Figure 3-2 depicts the set of major training events encompassed by these factors. Although the full set includes twenty-four events, only eleven will be considered by TRACES. The reasons for excluding events are:

(1) Field exercises involving ground units will necessarily engage in air support activities;

(2) MAF field exercises are too large to omit air defense;

(3) All CPX's will involve both air support and air defense; and

(4) A MAU CPX is too small to involve the MACCS.

One of the eleven remaining events, the field exercise with MAU engaged in both air defense and air support, is feasible, but uncommon. It is included in TRACES as an experiment to assess its effectiveness. Thus, the eleven major training events are the following:

(1) Field exercise with a MAF, both air support and air defense;

(2) Field exercise with a MAB, both air support and air defense;

(3) Field exercise with a MAU, both air support and air defense;

	FX			CPX		
	Air Defense	Air Defense	Both	Air Defense	Air Support	Both
Aviation Only	X	X	X			X
With MAU		X	X			
With MAB		X	X			X
With MAF			X			X

Figure 3-2

MAJOR TRAINING EVENTS USED BY TRACES

(4) Field exercise with aviation only, both air support and air defense;

(5) Field exercise with a MAB, air support only;

(6) Field exercise with a MAU, air support only;

(7) Field exercise with aviation only, air support only;

(8) Field exercise with aviation only, air defense;

(9) Command post exercise with a MAF only, air defense and air support;

(10) Command post exercise with a MAB, air defense and air support; and

(11) Command post exercise with aviation only, air defense and air support.

For each major training event, each of six MACCS agencies (i.e., TACC, TAOC, DASC, LAAM, ASRT, and FAAD) was characterized in terms of varying levels of deployment. Section 2.0 presented the potential deployment configurations for a field exercise with a MAF. The potential deployment configurations for the ten other major training events are provided in Appendix A.

TRACES will use a general benefit-cost algorithm to identify the most cost-effective MACCS deployment configuration for each of the selected major training events. Figure 3-3 presents a schematic of the benefit model within TRACES for the field exercise with the MAF, which was illustrated in Section 2.0. The benefit model includes the same MAUA hierachy

ALLOCATION CHOICES

TACC: Non-Deployed
Deployed TACC
TAOC: Non-Deployed
Early Warning
Deployed
DASC: DASC
DASC + Mini
LAAM: None
1 BTRY
2 BTRY
3 BTRY
ASRT: None
1 ASRT (no ord)
1 ASRT (w/ord)
2 ASRT (no ord)
2 ASRT (w/ord)
3 ASRT (no ord)
3 ASRT (w/ord)
FAAD: None
1 PLATOON (no ord)
1 PLATOON (w/ord)
2 PLATOONS (no ord)
2 PLATOONS (w/ord)

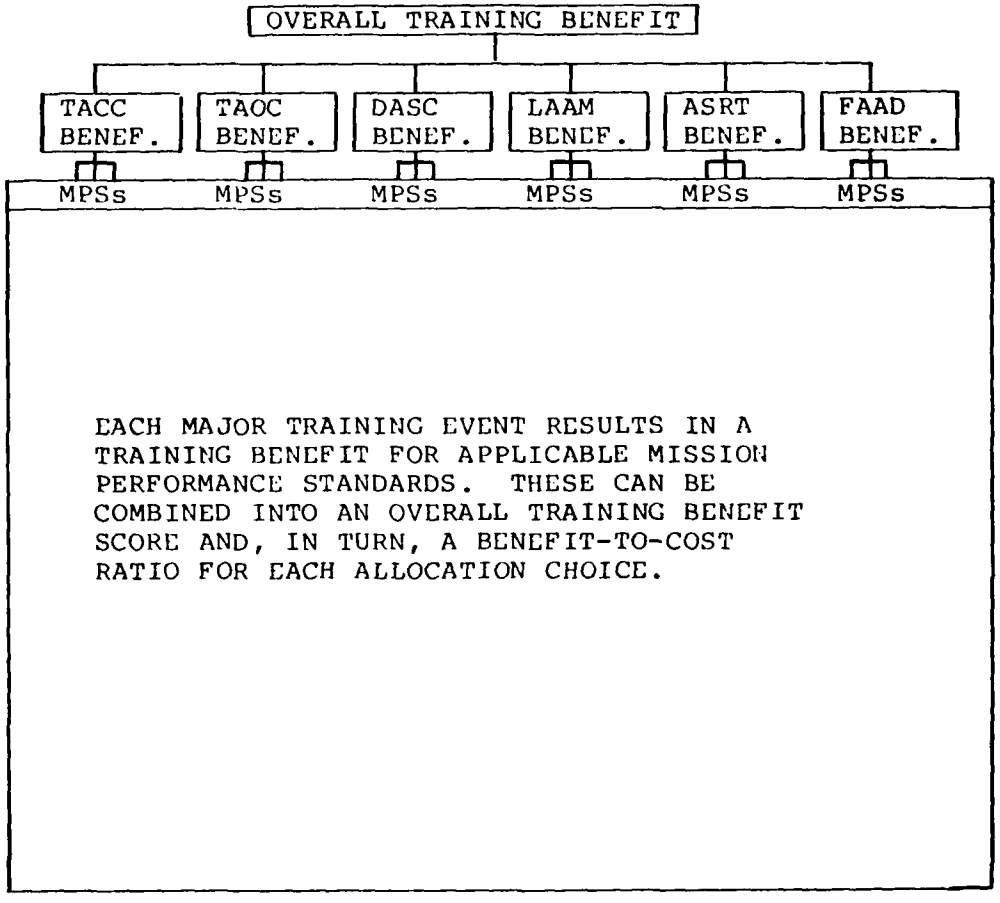


Figure 3-3

SCHEMATIC REPRESENTATION OF THE MACCS BENEFIT MODEL FOR RESOURCE ALLOCATION CHOICES IN A FIELD EXERCISE WITH A MARINE AMPHIBIOUS FORCE

as in MCCRES to ensure the explicit integration of the evaluation and training components of the overall system. The top-level factor is the overall benefit to the MACCS that is produced by any of the 1,120 possible deployment configurations that might be selected to support field exercise with the MAF. Overall benefit is decomposed into the benefits obtained for each agency which, in turn, are decomposed into the benefits obtained for each of the MPSs for that agency. (Marine Corps personnel thought the MPSs accurately reflected MACCS strengths and weaknesses; therefore, tasks and requirements were not included in the model.)

Working together, DDI analysts and Marine Corps personnel, obtained estimates of the relative training effectiveness on each MPS of each agency's alternative deployment configurations. In addition, the cost of the deployment configurations was also estimated. Both the cost and the training effectiveness estimates were assessed for the eleven major training events. Using these estimates, TRACES will calculate a benefit-cost ratio for every deployment configuration. The greatest overall benefit is provided by deployment configurations that effectively exercise important MPSs for which poor performance was observed. The most cost-beneficial MACCS deployment configuration is the set of agency deployments that provides the greatest improvement in combat readiness, for the level of money available for training. That is, it is the option on the efficient curve for a specific cost level (e.g., see Figure 2-1). As the amount of money varies, the most cost-beneficial exercise varies. Marine Corps personnel will be able to use TRACES to identify the best deployment configuration for each of the eleven major training events.

In addition, Marine Corps personnel will be able to identify the major training event that produces the most combat

readiness return to the MACCS for different levels of cost. This capability is achieved by comparing the costs and benefits for the deployment configurations that lie on the efficient curve for each major training event. This capability is represented schematically in Figure 3-4. In general, smaller training exercises cost the MACCS less to conduct, and produce less combat readiness return than the larger, more complex events. On occasion, however, full-scale deployment configurations of smaller events may provide the MACCS with more cost-effective training than that provided by relatively austere deployment configurations of larger events. TRACES will be able to identify these occasions, which are where the efficient curves cross each other in Figure 3-4. Such information should assist Marine Corps personnel in suggesting varied major training events, thereby facilitating cost-effective training for the MACCS.

In summary, the system has two major components: an explicit evaluation model (MCCRES) that specifies how well MACCS agencies are performing their functions, and an explicit training model (TRACES) that, based on the MCCRES scores, specifies the most beneficial major training events and deployment configurations for specific levels of cost. The training model includes all feasible MACCS deployment configurations for eleven major training options. The model also includes estimates of the relative training effectiveness and cost for each deployment configuration. Consequently, a benefit-cost ratio can be calculated for every deployment configuration; TRACES simply identifies the deployment configuration for the selected major event(s) that provides the highest total benefit-cost ratio at a specific level of cost.

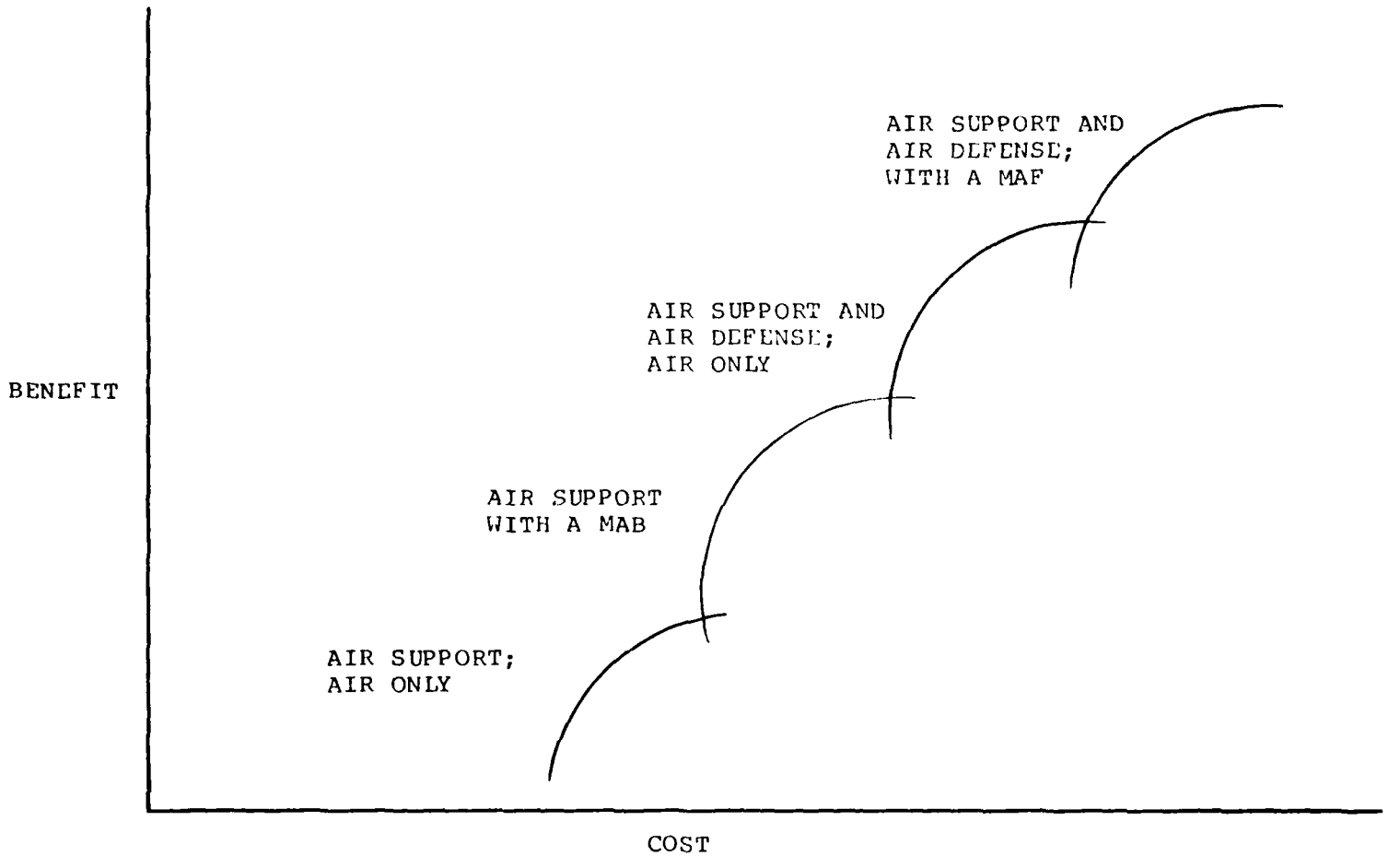


Figure 3-4

SCHEMATIC REPRESENTATION OF DEPLOYMENT CONFIGURATIONS
ON THE EFFICIENT FRONTIER FOR DIFFERENT MAJOR TRAINING EVENTS

3.2 Costs and Effectiveness Assessments

Participating Marine Corps personnel assessed the cost and relative effectiveness of each of the deployment configurations for the eleven major training events. The assessments for a field exercise with a MAF (illustrated in Section 2.0) are described in this section to help the reader better understand the technical approach used to implement TRACES. In particular, Section 3.2.1 describes the cost assessments; Section 3.2.2 describes the relative effectiveness (or benefit) assessments; and Section 3.2.3 describes the calculations used to determine the overall training benefit for a given MACCS deployment configuration. The different deployment configurations for a field exercise with a MAF are shown in Table 3-1.

3.2.1 Costs - Current dollar figures of the operational cost for different deployment configurations for each MACCS agency are being collected by appropriate Marine Corps personnel. In lieu of more accurate cost data, estimates of the operational cost of each MACCS deployment configuration for each of the eleven major options have been assessed. The estimates for a five-day, field exercise with a MAF are shown in Table 3-2. The cost estimates for each configuration include average travel costs. TRACES will, of course, permit MACCS personnel to input the specific operational and travel costs for particular units. Again, it must be stressed that all cost estimates in Table 3-2 are for illustrative purposes; they do not represent official Marine Corps cost figures.

3.2.2 Relative effectiveness assessments - Some deployment configurations are more effective in training certain agencies than others, and even in training certain MPSs within

AGENCIES	DEPLOYMENT CONFIGURATIONS							
	1	2	3	4	5	7	8	9
TACC	Non-Deployed	Deployed						
TAOC	Non-Deployed	Early Warning	Deployed					
DASC	Full	Full + Mini						
LAAM	None	1 BTRY	2 BTRY	3 BTRY				
ASRT	None	1 ASRT No Ordnance	1 ASRT Ordnance	2 ASRT No Ordnance	2 ASRT Ordnance	3 ASRT No Ordnance	3 ASRT Ordnance	
FAAD	None	1 PLATOON No Ordnance	1 PLATOON Dummy Ordnance	2 PLATOONS No Ordnance	2 PLATOONS Dummy Ordnance			

Table 3-1

MACCS DEPLOYMENT CONFIGURATION CHOICES FOR FIELD EXERCISE WITH A MAF

TACC:	Non-Deployed	$ 10,000
	Deployed	$ 75,000
TAOC:	Non-Deployed	$ 15,000
	Early Warning	$ 15,000
	Deployed	$ 80,000
DASC:	DASC	$ 40,000
	DASC + Mini	$ 55,000
LAAM:	None	0
	1 BTRY (No Missiles)	$ 20,000
	2 BTRY	$ 80,000
	3 BTRY	$100,000
ASRT:	None	$ 0
	1 ASRT (No Ord)	$ 20,000
	1 ASRT (With Ord)	$ 25,000
	2 ASRT (No Ord)	$ 40,000
	2 ASRT (With Ord)	$ 50,000
	3 ASRT (No Ord)	$ 60,000
	3 ASRT (With Ord)	$ 75,000
FAAD:	None	0
	1 Platoon (No Ord)	$ 6,000
	1 Platoon (With Dummy Ord)	$ 8,000
	2 Platoons (No Ord)	$ 12,000
	2 Platoons (With Dummy Ord)	$ 16,000

Table 3-2

ESTIMATED $ COST FOR EACH OF THE DEPLOYMENT CONFIGURATIONS FOR A FIVE-DAY FIELD EXERCISE WITH A MAF

agencies. Consequently, participating MACCS personnel estimated the relative effectiveness of each deployment configuration, for each of the eleven major events, in training each MPS for each MACCS agency. Relative effectiveness was defined as the percentage of the deficit made up (PDMU) on the agency's MPS by the chosen deployment configuration. The more effective the configuration in training a given MPS, the higher the PDMU. In all cases, it was assumed that the MACCS agency had received a score of 70 on its MCCRES evaluation in order to provide a baseline for estimating the PDMU for each deployment configuration. Furthermore, it was assumed that the relative effectiveness of a given configuration did not depend on the other choices.

Table 3-3 presents the relative effectiveness estimates (PDMUs) for the deployment configurations for a field exercise with MAF (air defense and air support), for the five MPSs for the Tactical Air Command Center (TACC). The table shows that a non-deployed TACC can be expected to make up:

- 20% of the deficit on the "phase control ashore" MPS,
- 25% of the deficit on the "display" MPS,
- 60% of the deficit on the "management of aircraft" MPS,
- 10% of the deficit on the "external agencies" MPS, and
- 35% of the deficit on the "succession of command and control" MPS.

TACC

		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC OF C^2
TACC:	Non-Deployed	20	25	60	10	35
	Deployed TACC	50	25	60	30	45
TAOC:	Non-Deployed	20	44	20	50	20
	Early Warning	10	22	10	10	20
	Deployed TAOC	22	44	20	70	30
DASC:	DASC	20	25	20	0	15
	DASC + Mini	22	25	20	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY	2	2	0	0	5
	2 BTRY	2	2	0	0	5
	3 BTRY	2	2	0	0	5
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	2	2	0	0	0
	1 ASRT (w/ord)	2	2	0	0	0
	2 ASRT (no ord)	2	2	0	0	0
	2 ASRT (w/ord)	2	2	0	0	0
	3 ASRT (no ord)	2	2	0	0	0
	3 ASRT (w/ord)	2	2	0	0	0
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	2	2	0	0	5
	1 PLATOON (w/ord)	2	2	0	0	5
	2 PLATOONS (no ord)	2	2	0	0	5
	2 PLATOONS (w/ord)	2	2	0	0	5

Table 3-3

RELATIVE EFFECTIVENESS SCORES FOR TACC MPSs FOR A FIELD EXERCISE WITH A MAF

In contrast, a deployed TACC can be expected to make up 50%, 25%, 60%, 30%, and 45%, respectively, on the five MPSs, and so forth. As can be seen, the relative effectiveness of the more expensive deployed TACC, over the less expensive non-deployed TACC, depends on the MPS. For example, the deployed TACC is two and one-half times more effective on "phase control ashore," yet not any more effective on "management of aircraft," a MPS for which a non-deployed TACC is extremely effective. Although the relative effectiveness of different deployment configurations depends on the MPS, the more inexpensive configuration for each agency almost never provides more training benefit than the most expensive configuration. (The only exceptions occur when the firing of missiles in certain training events prohibits full training on a MPS because of safety restrictions.)

In designing a five-day field exercise with a MAF, MACCS personnel must select one deployment configuration for each of the six agencies in order to define the exercise. The total benefit of that exercise for each MPS can be determined by simply adding the PDMUs for the six selected levels. For example, the least costly integrated field exercise with a MAF, is composed of a nondeployed TACC, a nondeployed TAOC, and a full DASC; there is no LAAM, ASRT, or FAAD. For the TACC, this exercise can be expected to make up 60% of the deficit in "phase control ashore": 20% by the non-deployed TACC; 20% by the nondeployed TAOC; and 20% by the full DASC. In contrast, the exercise can be expected to make up 94% of the deficit in "display" and 100% of the deficit in "manage aircraft." In a similar fashion, this deployment configuration will make up a specific percentage of the deficits (PDMUs) for the MPSs in each of the other five MACCS agencies.

In contrast, the most expensive exercise, that is, one comprised of a deployed TACC, a deployed TAOC, a mini- and a full DASC, three LAAM batteries, three ASRT with ordnance, and two FAAD platoons will make up 100% of the deficit on all five TACC MPSs. However, an examination of the PDMUs for the LAAM, ASRT, and FAAD reveals that the same readiness return to the TACC can be achieved by deploying only one of each of these types of agencies. The more expensive deployment configuration, however, may provide considerably more training on the important MPSs for the other five agencies, especially those on which a particular MACCS agency performed poorly; it may, therefore, be well worth the added training cost. TRACES will select the exercise, defined in terms of the level on each variable, that provides the most training benefit for specific levels of cost, across all MACCS agencies. These are the deployment configurations that lie on the efficient curve for a field exercise with a MAF (e.g., see Figure 2-2).

It is important to note that the relative effectiveness of individual deployment configurations depends on the major training event. Table 3-4, for example, presents the relative effectiveness scores (PDMUs) for a "field exercise with aviation only; air support." Three aspects of Table 3-4 should be noticed when compared to Table 3-3: First, there are fewer deployment configurations for an air support field exercise than for a field exercise with a MAF; for example, there is no deployed TAOC or LAAM or FAAD. Second, the same configurations often have smaller PDMUs for an air support exercise because there is no training on air defense. To illustrate, a deployed TACC within an air support exercise is expected to make up only 40% of the deficit on "phase control"; and to make up 50% of the deficit in a full exercise. And third, the best air support exercise does not make up 100% of the deficit in the MPSs. As an example, a deployed

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC OF C^2
TACC:	Non-Deployed	20	15	40	10	35
	Deployed TACC	40	15	40	20	45
TAOC:	Non-Deployed	20	25	15	25	15
	Early Warning	10	22	10	10	15
DASC:	Non-Deployed	15	25	25	0	20
	Mini	18	25	25	0	20
	DASC	20	25	25	0	20
ASRT:	1 ASRT (no ord)	2	2	0	0	0
	1 ASRT (w/ord)	2	2	0	0	0
	2 ASRT (no ord)	2	4	0	0	0
	2 ASRT (w/ord)	2	4	0	0	0
	3 ASRT (no ord)	2	6	0	0	0
	3 ASRT (w/ord)	2	6	0	0	0

Table 3-4

RELATIVE EFFECTIVENESS SCORES FOR TAAC
MPSs FOR A FIELD EXERCISE WITH AVIATION ONLY;
AIR SUPPORT

TACC, a nondeployed TAOC, a DASC, and three ASRT with ordnance make up only 45% of the deficit in the "external agencies'" MPS. This emphasizes the point that the relative effectiveness of particular resources for training depends on the larger training exercise of which they are a part. Only the model for the field exercise with a MAF ensures that the most expensive deployment configuration will make up 100% of the deficit on each MPS for each agency. (The relative effectiveness scores [PDMUs] for each level of each of the eleven training events, for all six agencies' MPSs are presented in the Appendix.)

3.2.3 Calculating the overall training benefit of a set of resource allocation choices - Training benefit will be defined here as the number of MCCRES points that one can expect to make up with a particular training exercise, where an exercise is comprised of one, and only one, deployment configuration for each agency. This measure of training benefit is calculated in a series of steps. First, one calculates the points made up (PMU) on each MPS for each deployment configuration of each agency. This is the product of three terms: (1) the PDMU for that MPS and deployment configuration (e.g., in a five-day field exercise with a MAF, a nondeployed TACC can be expected to make up about 20% of the MCCRES deficit on the TACC's ability to phase control ashore); (2) the agency's MCCRES deficit on that MPS (e.g., assume that the TACC scored a "70" on "phase control ashore"); and (3) the importance of that MPS. This step is illustrated with the following notation:

$$PMU_{i,j} = PDMU_{i,j} \times [100\text{-}Score_i] \times WT_i$$

where

i = the MPS

j = the deployment configuration.

Second, given a particular combination of deployment configurations for agencies, one calculates the total points made up on an MPS, for that deployed configuration by summing the appropriate $PMU_{i,j}$ values for that MPS. For example, the total points made up on "phase control" for the least expensive integrated field exercise with air only is represented by the following operation:

$$PMU_{P.C.} = \sum_{j=1}^{6} PMU_j$$

where "j" represents the deployment configuration for each of the six agencies.

Third, one calculates the total points made up for an agency by a particular combined deployment configuration by summing the points made up for all MPSs. As an illustration,

$$PMU_{TACC} = \sum_{i=1}^{5} PMU_i$$

where "i" represents the agency MPSs.

Finally, the overall points made up (PMU_{ov} by the exercise are calculated by summing the PMUs for the agencies. That is,

$$PMU_{ov} = \sum_{a=1}^{6} PMU_a$$

where "a" represents the MACCS agencies.

The most beneficial major training option for a specific level of cost is the exercise that makes up the most points overall (i.e., has the highest PMU_{ov}) for that level of cost.

The predicted MCCRES score for a MACCS agency's next evaluation, assuming the designated training occurs, is its previous MCCRES score, plus the estimated overall PMU. TRACES, however, cannot guarantee that the unit will receive this score. The PDMUs and, in turn, PMUs are expected values; they represent only how well the unit can be expected to perform on the average. These values represent the best judgment of MACCS personnel who participated in the study. They are, of course, subject to revision on the basis of future evaluations of training effectiveness.

4.0 USER INTERFACE

The user interface of a computer system includes the methods by which the user provides input to the computer, the methods by which the user controls the computer, and the displays and printouts provided by the computer. This is the level at which a user typically understands a system. The technical details, although vital, are usually treated as a "black box." The user's perspective is largely a matter of what he must do to the system and what he will obtain from it.

In TRACES, the user's interaction with the system will be organized in terms of menus. These menus display a set of user options, which can be selected by typing the number associated with the desired option. This is a very effective technique for enabling a casual or untrained user to control a system.

Figure 4-1 presents the main menu that will be used in TRACES. This display will appear as soon as the system is initialized. Selection of one of these main options will cause the computer either to take the appropriate action or to display a menu of suboptions. Thus, menus can be nested or placed in a hierarchy. Figure 4-2 presents the hierarchy of menus anticipated for TRACES. The sections that follow discuss the user's activities upon selection of a particular option or suboption.

4.1 Enter MCCRES Scores

A TRACES analysis begins with the entry of a new set of MCCRES scores. Although other assessments such as costs,

MAIN MENU

1. ENTER MCCRES SCORES
2. CONDUCT ANALYSIS
3. MODIFY ASSESSMENTS
4. ADD/DELETE MPS
5. STORE/RETRIEVE FILES

PLEASE ENTER THE APPROPRIATE NUMBER: _____

Figure 4-1
TRACES TOP LEVEL MENU

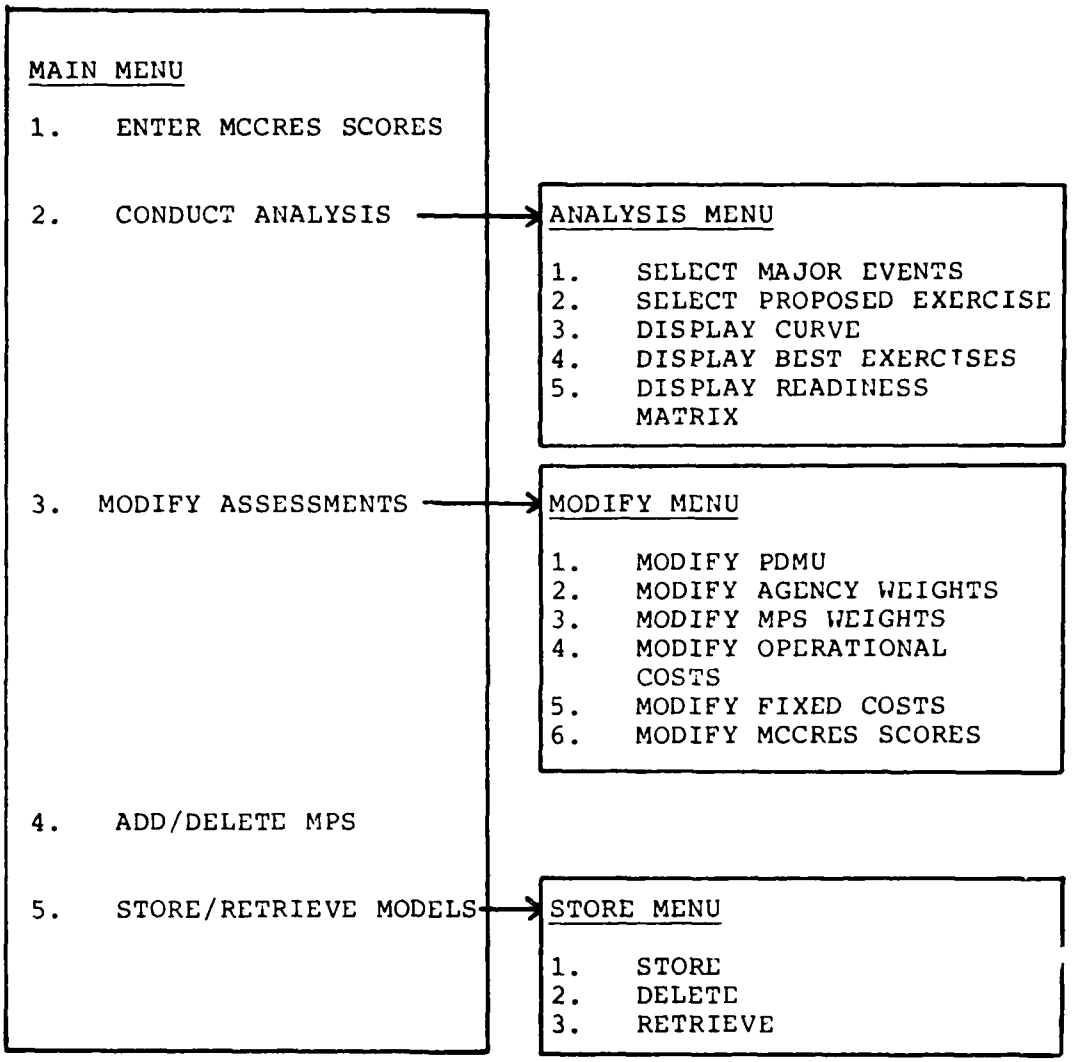


Figure 4-2

TRACES HIERARCHY OF MENUS

MCCRES weights, and PDMUs are equally vital to the analysis, they will be stored and available to the computer. The other assessments will be modifiable (see Section 4.3), but their entry will not be required prior to an analysis. Only the MCCRES scores will need to be entered.

Upon selecting this option, TRACES will prompt the user for each of the twenty-five MPS scores that are relevant to MACCS. Unlike the earlier TRACES developed for the Infantry, the present system will not attempt to read MCCRES data directly from a MCCRESSA diskette. This change of procedure was required by the change in perspective that views the MCCRES for the MACCS as a way of measuring Marine Corps-wide readiness rather than individual unit readiness. Any single MCCRES evaluation is seen as only one observation of many. The appropriate input to TRACES is not the single observation, but an aggregated performance over many evaluations. However, since there is not yet an automatic technique for aggregating MCCRES evaluations, this must be done by the user and input to TRACES by hand.

Once the MCCRES scores have been entered into TRACES the user will be informed that a substantial delay will be needed, while TRACES computes. These computations are the foundation of the analysis and may require between ten and thirty minutes to be completed. The delay is being introduced at this point in order to avoid lengthy delays during the examination of the model's implications.

4.2 Conduct an Analysis

Once this option is selected, TRACES will first check to ensure that a fully developed model is available for analysis. Such a model would be available if MCCRES scores were just

entered or a previously stored model had been retrieved. If a model is not available, TRACES will inform the user of the problem and return him to the main menu. Otherwise, the following suboptions will be presented.

4.2.1 Select major events - For any particular Major Training Event, e.g., FX-air only-air defense or CPX-with MAF, a TRACES analysis is much the same as the example analysis described in Section 2.0. The various deployment configurations for the major option are examined and analyzed for optimality in terms of cost versus readiness benefit from the training. The set of optimal deployment configurations is then presented to the user.

The present system is much the same, but it permits the user to specify one, several, or all major events as part of the analysis. If only one major event is selected, then its best deployment configurations will be considered. If several major events are selected, then the best deployment configurations from the designated set of events will be evaluated in relation to one another. Should any deployment configurations from one major event dominate those of another, only the best event will be communicated to the user.

Figure 4-3 depicts the method by which optimal deployment configurations from two major events are compared. The points marked A and B represent optimal configurations for major events A and B, respectively. Although these configurations may be optimal when the major event is considered in isolation, not all are optimal when the two major events are compared. In particular, the circled points correspond to deployment configurations that are dominated by a configuration based on the other major event. They are, therefore, suboptimal, when both major events are being considered. The

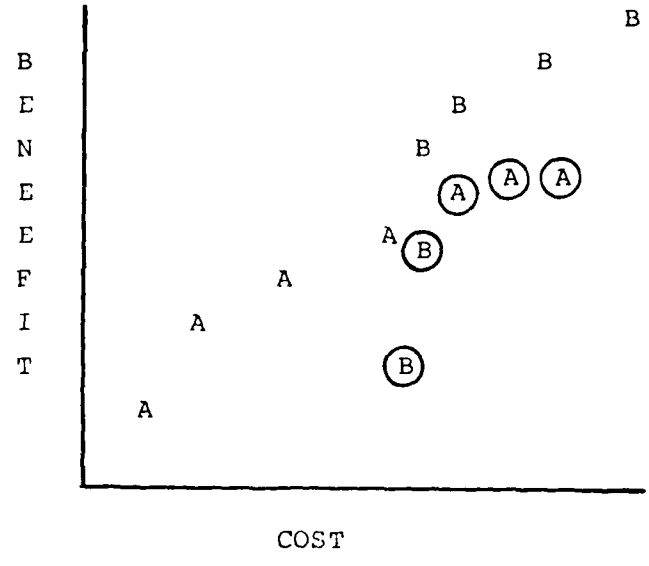


Figure 4-3

THE BEST DEPLOYMENT CONFIGURATIONS FROM
TWO MAJOR TRAINING EVENTS (A and B)

technique for finding the optimal configurations for two major events is easily extended to encompass larger sets of major events.

The selection of the major events for consideration is an important step in a TRACES analysis. The user should include any major training events that are plausible and avoid including ones that are totally unrealistic, given his constraints. (In the event that no major events are selected, TRACES will assume that all major events are possible.)

4.2.2 Select proposed exercise - An integral component of the cost-benefit approach is the ability to specify a proposed exercise. This permits the user to compare his intuitions, plans, or guidance with the implications of the analysis. If his proposed exercise is one of the optimal ones, then there is little basis for changing one's plans. If, however, the proposed exercise falls below the set of optimal exercises, then a careful examination of the reasons for the shortfall can be conducted.

TRACES will assist the user in specifying a proposed exercise by prompting him through a set of choices. First, it will require that the user select a major event (from the set being analyzed). Then, it will systematically request a deployment configuration for each of the agencies comprising the exercise. In the event that the user fails to either select or complete this suboption, TRACES will assume any previous proposal still applies.

4.2.3 Display curve - The primary graphical representation of the benefit/cost analysis is the curve which depicts the set of optimal exercises (see Section 2.0). Selection of this option presents the curve.

In the event that a proposed exercise is available, the curve will identify it, as in Figure 4-4. The set of optimal exercises is indicated by asterisks, the proposed exercise by a P; an exercise that is cheaper than the proposed, but just as beneficial, by a C; and a better exercise that costs the same as the proposed, by a B. Since the primary value of comparing the proposed exercise to the optimal exercises is derived from a detailed comparison of the cheaper and better exercises, this capability will also be provided. Thus, after viewing the curve, the user will be offered an opportunity to compare the deployment configurations of the proposed (P), cheaper (C), and better (B) exercises.

4.2.4 Display best exercises - Should the user select this suboption, he will be provided information about all of the exercises comprising the set of optimal exercises. Starting with the least costly exercise, each optimal exercise will be described in terms of its cost, anticipated readiness-return, and deployment configuration. In essence, this suboption is simply describing the exercises that correspond to the asterisks of Figure 4-4.

4.2.5 Display readiness-matrix - The final analysis suboption is a display of the readiness-return a specified exercise will provide to each of the MACCS agencies. Figure 4-5 depicts an example of this capability. The rows of the matrix correspond to the selected deployment configuration for each of the agencies. The columns represent the aggregated MPS readiness-return provided to each agency by the identified deployment configurations. Columns for cost and overall readiness return are also provided. Overall, this matrix will indicate the value of each agency to the training of each of the other agencies. The zeros in Figure 4-5 indicate that (1) the LAAM receives no benefit from the other agencies

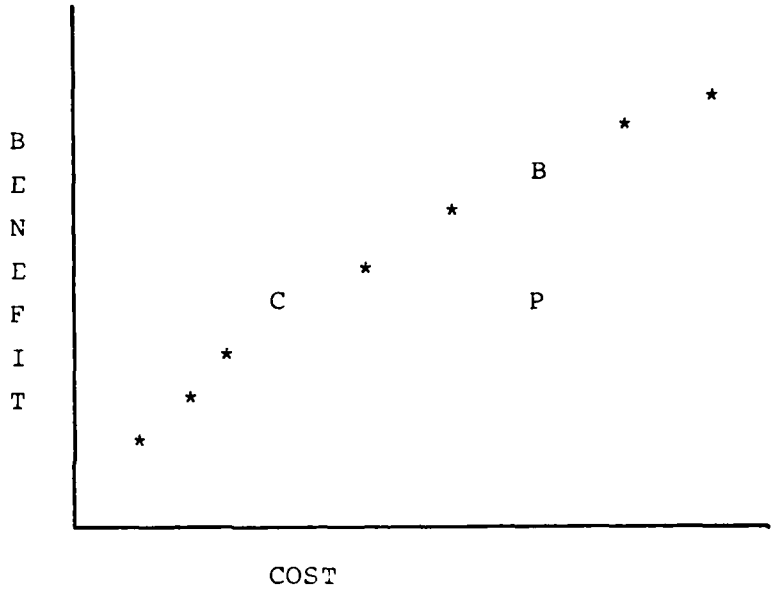


Figure 4-4

THE BENEFIT/COST CURVE WITH A PROPOSED EXERCISE PLOTTED

READINESS RETURN

Exercise=FX-MAF-Air Defense and Air Support

CONFIGURATION	COST	TACC MPSs	TAOC MPSs	DASC MPSs	ASRT MPSs	LAAM MPSs	FAAD MPSs	OVERALL
TACC: Deployed						0		
TAOC: Non-Deployed						0		
DASC: Mini						0		
ASRT: 1 ASRT						0		
LAAM: None	0	0	0	0	0	0	0	0
FAAD: 1 Section						0		
TOTAL								

Figure 4-5

EXAMPLE OF READINESS MATRIX

(indicated by zeros in the LAAM column) and provides none to them (indicated by the zeros in the LAAM row).

TRACES will offer the user three techniques for specifying an exercise to be decomposed into a readiness matrix. The user can (1) specify a cost and allow TRACES to select the optimal exercise that most nearly conforms to that cost, (2) specify a desired readiness-return and allow TRACES to select the optimal exercise that most nearly provides the required readiness, or (3) request that the proposed exercise (see Section 4.2.2) be decomposed into a matrix.

4.3 Modify Assessments

TRACES computations are based upon estimates that will have been derived prior to their usage. These assessments represent the best estimate of the moment and embody much detailed knowledge about the MACCS. They are not, however, infallible. Therefore, provision will be made for allowing the user to modify the assessments.

Before discussing these suboptions for modifications individually, two considerations deserve mention. First, assessment modifications should be made with care and only by personnel who are familiar with the computational underpinnings of TRACES. The current assessments are the product of lengthy and detailed discussion (especially the PDMUs) and should, therefore, be given the benefit of the doubt. In other words, changes should require thorough justification.

Second, modifications to assessments constitute a change in the models. Therefore, upon leaving this option, reoptimization will be required. This could require up to thirty minutes depending upon the nature of the change.

4.3.1 Modify percent deficit made up (PDMU) - The percent deficit made up (PDMU) by each deployment configuration on each mission performance standard (MPS) is the core of the TRACES analysis. It relates readiness return to cost. Although TRACES will provide for the modification of these assessments, this should be done with great care.

To specify a PDMU for modification, the user will be asked to identify a major training event, an agency and its deployment configuration, and an MPS. At this point TRACES will display the current value and the maximum value to which the PDMU can be changed.

This maximum is displayed in order to ensure that the user does not inadvertently enter a number that would imply the availability of a deployment configuration providing more than 100% of the deficit made up. Now the user can enter a new PDMU provided that the new value is within the specified bounds.

4.3.2 Modify agency weights - In addition to the MCCRES scores, TRACES requires an additional input from the readiness evaluation. These are the MCCRES importance weights on both the MACCS agencies and their MPSs. The present suboption will permit the user to modify the importance weights for the agencies.

4.3.3 Modify Mission Performance Standard (MPS) weights - This suboption is similar to the previous one. It will allow a user to modify the weights on the MPS of a specified agency.

4.3.4 Modify operational costs - TRACES will base its computations on two types of cost estimates. First, "operational costs," are costs that vary as a function of the deployment configuration. They will be modifiable when both a major training event and a specific deployment configuration are specified for an agency. Then, the current cost estimate will be displayed and offered for modification. The second type of cost, "fixed costs," are constant for any major training event regardless of deployment configuration. Fixed costs are discussed in Section 4.3.5, below.

4.3.5 Modify fixed costs - Fixed costs are costs associated with a major training event and will be modifiable upon designation of the appropriate major training event. This will cause the current estimate to be displayed and offered for modification.

4.3.6 Modify MCCRES scores - There are three reasons for providing a capability to modify MCCRES scores. First, scores that were previously entered and stored may require only slight modification to reflect a new evaluation summary. Second, it may seem appropriate to conduct sensitivity analyses by systematically varying a particular score. And finally, a score may be in error and require editing.

MCCRES scores will be modifiable upon specifying an Agency and an MPS of interest. The current score will then be displayed and offered for modification.

4.4 Add/Delete MPS

Modifications to the structure of TRACES have the most far-reaching effects on the TRACES analysis. When MPSs are added or deleted the PDMU assessments and weights must be

reviewed for accuracy and completeness. Since there is no simple way to do this automatically, extreme care is required when selecting this option.

Should the user decide to delete an MPS, the problem is relatively simple. The PDMUs and weight associated with the MPS will be eliminated. In addition, the weights of the other MPS's within that agency will be normalized to add to 1.00. Finally, the user will be advised to review all weights lest the deletion has affected his estimate of the importance of an agency or MPS. Since MPS deletion does change the assessments, reoptimization will be required following selection of this suboption.

In the event the user selects the addition of an MPS the situation is more problematic. An MPS will be added to the designated agency, but its PDMUs and weight will be initialized to zero. TRACES can assume little else. It can, however, warn the user that the MPS values are likely to require modification and that he should, therefore, select the appropriate menu options (see Section 4.3). Reoptimization will occur once the weight and PDMUs are set.

4.5 Store/Retrieve Models

Although it is uncertain how much space will be required to support one TRACES model, insofar as it is possible, an effort will be made to provide the ability to store, delete, and retrieve multiple models. In this way, the user will be able to record a sequence of analyses based on successive MCCRES evaluations. Or, he will be able to record a worst and best case model. These capabilities are desirable and, disk storage permitting, will be made available.

5.0 SYSTEM SUPPORT IMPLICATIONS

TRACES, like any other computer system, will require support if it is to be maintained and developed further. The exact nature of the future support requirements cannot be fully predicted, especially since it is uncertain how the Marine Corps will choose to use, maintain, and further improve TRACES. Nevertheless, certain broad implications can be drawn.

Before discussing TRACES support implications, three facts must be recognized.

(1) TRACES will be implemented on an IBM 5110 computer.

(2) TRACES will be implemented in APL.

(3) TRACES, as currently envisioned, is intended to be a headquarters tool used by the MCCRES team.

These facts form the basis for a discussion of two primary scenarios: one in which the Marine Corps uses TRACES as developed and another in which the Marine Corps converts TRACES to COBOL for operation on the IBM Series-1 computer.

5.1 Hardware Maintenance

At present, the MCCRES team at Marine Corps Headquarters has access to an IBM 5110 and could gain access to an IBM Series-1. Undoubtedly, the Marine Corps has considerable experience with the comparative reliability of these systems and would know best which hardware system requires the most support. In either case, a support arrangement with IBM is

likely to be required. Thus, unless the Marine Corps experience with either machine has been unduly negative, hardware maintenance seems likely to be comparable on any Marine Corps computer.

5.2 Software Maintenance

Most software is released in a form that requires additional attention. Sometimes, despite a vendor's best efforts to test the software prior to its release, "bugs" remain. Unless a dispute arises about the cause or realness of a bug, they are not of great concern since the vendor should be prepared to correct bugs, even following the software's release.

The important issue for software maintenance is the desire for system modifications following software release. Changes in the format of printouts or displays and new sorting or filing capabilities are examples of minor modifications that are frequently requested following software development. Support for such changes must either be provided internally by the customer or by a vendor.

Software maintenance takes on a new dimension for TRACES, because it will be implemented in APL. APL is not an especially prevalent language and it cannot be assumed that Marine Corps personnel are proficient in its use. Thus, assuming that TRACES will remain in APL, the following options will be considered: (1) APL will be used without modification, (2) Marine Corps personnel will be trained in APL, or (3) a vendor will be hired to implement the modifications as needed.

If dependency upon a vendor for software maintenance is intolerable, then an alternative is to convert TRACES to COBOL or some other language with which Marine Corps personnel are

more familiar. Such a conversion could be expensive and would, of course, require personnel who are familiar with both APL and COBOL.

The result is that the Marine Corps is confronted with two potentially costly alternatives: pay for a support contract from an outside vendor or pay for conversion to COBOL. The factors guiding this choice are:

(1) The number of system modifications likely to be needed;

(2) The extent of the Marine Corps' requirement for independence of outside firms; and

(3) The lifetime of the MACCS TRACES.

In the event that TRACES requires very few modifications or is likely to become outmoded by a new generation of TRACES, the use of outside support is appropriate. If, however, TRACES was expected to remain in operation for many years, during which time numerous modifications would be required, then conversion to COBOL might be advantageous.

6.0 CONCLUSIONS AND RECOMMENDATIONS

The result of the Phase I effort on TRACES has been positive. It is possible to extend TRACES to encompass the MACCS. This requires some changes both in philosophy and design as compared to the infantry TRACES. In particular, MACCS scores from MCCRES must be aggregated prior to their use in TRACES. Also, TRACES for MACCS is envisioned as a headquarters tool rather than as a tool for allocating a battalion commander's remedial training funds. These modifications are both justified and required by the fact that the MACCS is a system, predominantly serving in a support role, which has great difficulty controlling its training cycle. The first recommendation of this report is to proceed to Phase II of the effort.

A second recommendation is that the Marine Corps should entertain the development of a MCCRES data management system. This could be used to store, record, and analyze MCCRES evaluations. It would serve the additional purpose of providing automatic procedures for aggregating the scores of separate MCCRES evaluations, which could then be used as input to TRACES.

The final recommendation is to continue TRACES development for its ultimate applicability to the entire MAGTF. TRACES would combine information from the many MCCRES volumes in an effort to determine the readiness returns from the training exercises of those Marine Corps units for which MCCRES standards apply. Although considerably more complex, such a system could readily build upon the MACCS TRACES. The MAGTF TRACES would require (1) development of an integrated benefit-cost framework for infantry, aviation, and support

units, (2) cost and benefit assessments for each of these major units, and (3) computer software incorporating an appropriately tailored benefit-cost algorithm to identify those major training exercises that provide the most combat readiness return for different levels of expenditure.

In conclusion, the MACCS TRACES is designed and ready for implementation. Also, the extension to the MACCSs strongly suggests continued development of the TRACES concept.

APPENDIX A
PERCENT DEFICIT MADE UP (PDMU)

APPENDIX A
PERCENT DEFICIT MADE UP (PDMU)

This Appendix lists the assessed values of the Percent Deficit Made Up (PDMU) by each deployment configuration on each Mission Performance Standard (MPS) and for each major training event. The eleven major training events under consideration are:

(1) FX; with MAF; Both Air Support and Air Defense
(2) FX; with MAB; Both Air Support and Air Defense
(3) FX; with MAU; Both Air Support and Air Defense
(4) FX; Air Only; Both Air Support and Air Defense
(5) FX; with MAF; Air Support Only
(6) FX; with MAU; Air Support Only
(7) FX; Air Only; Air Support Only
(8) FX; Air Only; Air Defense Only
(9) CPX; with MAF; Both Air Support and Air Defense
(10) CPX; with MAB; Both Air Support and Air Defense
(11) CPX; Air Only; Both Air Support and Air Defense

Most of the MPS definitions are taken from MCCRES Volume VIII, The Marine Air Command and Control System (MACCS) [MCO 3501.9; OTOR/giv; 13 December 1979]. The three FAAD and three LAAM MPSs are new.

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC:	Non-Deployed	20	25	55	20	35
	Deployed TACC	50	25	55	40	45
TAOC:	Non-Deployed	20	40	20	40	20
	Early Warning	10	20	10	10	20
	Deployed TAOC	22	40	20	60	30
DASC:	DASC	20	20	25	0	15
	DASC + Mini	22	20	25	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY	2	5	0	0	5
	2 BTRY	2	8	0	0	5
	3 BTRY	2	10	0	0	5
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	2	1	0	0	0
	1 ASRT (w/ord)	2	1	0	0	0
	2 ASRT (no ord)	2	2	0	0	0
	2 ASRT (w/ord)	2	2	0	0	0
	3 ASRT (no ord)	2	3	0	0	0
	3 ASRT (w/ord)	2	3	0	0	0
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	2	2	0	0	5
	1 PLATOON (w/ord)	2	2	0	0	5
	2 PLATOONS (no ord)	2	2	0	0	5
	2 PLATOONS (w/ord)	2	2	0	0	5

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	6	17	20	20
	Deployed TACC	12	3	6	17	20	25
TAOC:	Non-Deployed	10	10	30	25	40	40
	Early Warning	35	30	35	27	25	30
	Deployed TAOC	50	40	40	30	45	50
DASC:	DASC	11	7	3	13	20	15
	DASC + Mini	12	7	3	15	22	20
LAAM:	None	0	0	0	0	0	0
	1 BTRY	10	25	30	25	3	5
	2 BTRY	13	35	35	27	3	5
	3 BTRY	16	40	40	30	3	5
ASRT:	None	0	0	0	0	0	0
	1 ASRT (no ord)	1	1	1	2	3	0
	1 ASRT (w/ord)	1	1	1	2	3	0
	2 ASRT (no ord)	2	2	1	2	6	0
	2 ASRT (w/ord)	2	2	1	2	6	0
	3 ASRT (no ord)	3	3	1	2	8	0
	3 ASRT (w/ord)	3	3	1	2	8	0
FAAD:	None	0	0	0	0	0	0
	1 PLATOON (no ord;	5	5	10	3	1	0
	1 PLATOON (w/ord.)	5	5	10	3	1	0
	2 PLATOONS (no ord)	7	7	10	6	2	0
	2 PLATOONS (w/ord)	7	7	10	6	2	0

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	30	25	10	30
	Deployed TACC	15	35	32	10	30
TAOC:	Non-Deployed	10	10	7	20	5
	Early Warning	10	10	7	10	5
	Deployed TAOC	15	10	7	20	5
DASC:	DASC	40	40	40	40	35
	DASC + Mini	50	45	45	40	38
LAAM:	None	0	0	0	0	0
	1 BTRY	3	0	0	10	1
	2 BTRY	3	0	0	12	1
	3 BTRY	3	0	0	14	1
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	5	3	5	1	15
	1 ASRT (w/ord)	5	3	5	1	15
	2 ASRT (no ord)	5	6	10	1	20
	2 ASRT (w/ord)	5	6	10	1	20
	3 ASRT (no ord)	5	9	15	1	25
	3 ASRT (w/ord)	5	9	15	1	25
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	10	1	1	10	1
	1 PLATOON (w/ord)	10	1	1	10	1
	2 PLATOONS (no ord)	12	1	1	15	1
	2 PLATOONS (w/ord)	12	1	1	15	1

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	5	5
	Deployed TACC	0	5	5
TAOC:	Non-Deployed	30	25	30
	Early Warning	15	10	15
	Deployed TAOC	30	30	30
DASC:	DASC	0	0	0
	DASC + Mini	0	0	0
LAAM:	None	0	0	0
	1 BTRY	40	25	30
	2 BTRY	50	30	45
	3 BTRY	60	35	60
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
	2 ASRT (no ord)	0	0	0
	2 ASRT (w/ord)	0	0	0
	3 ASRT (no ord)	0	0	0
	3 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 PLATOON (no ord)	5	10	5
	1 PLATOON (w/ord)	5	10	5
	2 PLATOONS (no ord)	10	10	5
	2 PLATOONS (w/ord)	10	10	5

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	Deployed TACC	0	0	0
TAOC:	Non-Deployed	5	10	0
	Early Warning	5	10	0
	Deployed TAOC	5	10	0
DASC:	DASC	15	20	0
	DASC + Mini	20	25	0
LAAM:	None	0	0	0
	1 BTRY	0	0	0
	2 BTRY	0	0	0
	3 BTRY	0	0	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	30	30	15
	1 ASRT (w/ord)	35	35	45
	2 ASRT (no ord)	45	50	26
	2 ASRT (w/ord)	60	55	80
	3 ASRT (no ord)	50	60	32
	3 ASRT (w/ord)	75	65	96
FAAD:	None	0	0	0
	1 PLATOON (no ord)	0	0	0
	1 PLATOON (w/ord)	0	0	0
	2 PLATOONS (no ord)	0	0	0
	2 PLATOONS (w/ord)	0	0	0

FX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		FAAD		
		PHASE CTL	ENGAGE	TEAM SUPPT
TACC:	Non-Deployed	5	2	0
	Deployed TACC	5	2	0
TAOC:	Non-Deployed	10	5	0
	Early Warning	5	2	0
	Deployed TAOC	10	5	0
DASC:	DASC	15	10	25
	DASC + Mini	16	10	25
LAAM:	None	0	0	0
	1 BTRY	5	9	0
	2 BTRY	7	11	0
	3 BTRY	9	13	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
	2 ASRT (no ord)	0	0	0
	2 ASRT (w/ord)	0	0	0
	3 ASRT (no ord)	0	0	0
	3 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 PLATOON (no ord)	45	45	40
	1 PLATOON (w/ord)	45	55	50
	2 PLATOONS (no ord)	60	60	60
	2 PLATOONS (w/ord)	60	70	75

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC:	Non-Deployed	20	22	40	20	35
	Deployed TACC	50	22	40	40	45
TAOC:	Non-Deployed	20	40	20	40	20
	Early Warning	10	20	10	10	20
	Deployed TAOC	22	40	20	60	30
DASC:	Mini	20	20	23	0	15
	DASC	20	20	23	0	15
	DASC + Mini	22	20	23	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	2	5	0	0	5
	2 BTRY (agg air)	2	8	0	0	5
	3 BTRY (agg air)	2	10	0	0	0
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	2	1	0	0	0
	1 ASRT (w/ord)	2	1	0	0	0
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	2	1	0	0	5
	1 PLATOON (dummy ord)	2	1	0	0	5
	1 SECTION (no ord)	2	1	0	0	5
	1 SECTION (dummy ord)	2	1	0	0	5

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	6	17	15	20
	Deployed TACC	12	3	6	17	15	25
TAOC:	Non-Deployed	10	10	30	25	35	40
	Early Warning	35	30	35	27	20	30
	Deployed TAOC	50	40	40	30	40	50
DASC:	Mini	11	5	3	13	18	15
	DASC	11	5	3	13	20	15
	DASC + Mini	12	5	3	15	22	20
LAAM:	None	0	0	0	0	0	0
	1 BTRY (agg air)	10	25	30	25	3	5
	2 BTRY (agg air)	13	35	35	27	3	5
	3 BTRY (agg air)	16	40	40	30	3	5
ASRT:	None	0	0	0	0	0	0
	1 ASRT (no ord)	1	1	1	2	3	0
	1 ASRT (w/ord)	1	1	1	2	3	0
FAAD:	None	0	0	0	0	0	0
	1 PLATOON (no ord)	5	5	10	3	1	0
	1 PLATOON (dummy ord)	5	5	10	3	1	0
	1 SECTION (no ord)	3	3	3	1	1	0
	1 SECTION (dummy)	3	3	3	1	1	0

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	25	20	10	25
	Deployed TACC	15	30	25	10	25
TAOC:	Non-Deployed	10	8	5	20	5
	Early Warning	10	8	5	10	5
	Deployed TAOC	15	8	5	20	5
DASC:	Mini	25	25	22	30	27
	DASC	35	33	28	30	27
	DASC + Mini	45	35	30	30	30
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	3	0	0	10	1
	2 BTRY (agg air)	3	0	0	12	1
	3 BTRY (agg air)	3	0	0	14	1
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	5	3	5	1	15
	1 ASRT (w/ord)	5	3	5	1	20
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	10	1	1	10	1
	1 PLATOON (dummy ord)	10	1	1	10	1
	1 SECTION (no ord)	3	1	1	5	1
	1 SECTION (dummy ord)	3	1	1	5	1

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	3	5
	Deployed TACC	0	3	5
TAOC:	Non-Deployed	30	15	30
	Early Warning	15	5	15
	Deployed TAOC	30	20	30
DASC:	Mini	0	0	0
	DASC	0	0	0
	DASC + Mini	0	0	0
LAAM:	None	0	0	0
	1 BTRY (agg air)	40	20	30
	2 BTRY (agg air)	50	25	45
	3 BTRY (agg air)	60	30	60
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 PLATOON (no ord)	5	10	5
	1 PLATOON (dummy ord)	5	10	5
	1 SECTION (no ord)	3	5	5
	1 SECTION (dummy)	3	5	5

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	Deployed TACC	0	0	0
TAOC:	Non-Deployed	5	10	0
	Early Warning	5	10	0
	Deployed TAOC	5	10	0
DASC:	Mini	15	15	0
	DASC	15	20	0
	DASC + Mini	20	25	0
LAAM:	None	0	0	0
	1 BTRY (agg air)	0	0	0
	2 BTRY (agg air)	0	0	0
	3 BTRY (agg air)	0	0	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	30	30	15
	1 ASRT (w/ord)	35	35	45
FAAD:	None	0	0	0
	1 PLATOON (no ord)	0	0	0
	1 PLATOON (dummy ord)	0	0	0
	1 SECTION (no ord)	0	0	0
	1 SECTION (dummy ord)	0	0	0

FX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		FAAD		
		PHASE CTL	ENGAGE	TEAM SUPPT
TACC:	Non-Deployed	4	2	0
	Deployed TACC	4	2	0
TAOC:	Non-Deployed	8	4	0
	Early Warning	4	1	0
	Deployed TAOC	8	4	0
DASC:	Mini	8	6	15
	DASC	10	8	17
	DASC + Mini	10	8	17
LAAM:	None	0	0	0
	1 BTRY (agg air)	4	8	0
	2 BTRY (agg air)	6	10	0
	3 BTRY (agg air)	8	12	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 PLATOON (no ord)	40	40	35
	1 PLATOON (dummy ord)	40	50	45
	1 SECTION (no ord)	20	25	15
	1 SECTION (dummy ord)	20	30	20

FX; WITH MAU; BOTH AIR SUPPORT AND AIR DEFENSE

TACC: Non-Deployed

TAOC: Early Warning

DASC: DASC

ASRT: 1 ASRT (no ord)

FAAD: None
1 SEC (no ord)
1 SEC (dummy ord)

	TACC			
PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
15	15	15	15	15
20	15	20	15	15
15	15	15	15	15
5	15	1	10	10
0	0	0	0	0
1	1	0	5	2
1	1	0	5	2

FX; WITH MAU; BOTH AIR SUPPORT AND AIR DEFENSE

TAOC

	PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC: Non-Deployed	10	2	2	10	15	6
TAOC: Early Warning	40	40	40	40	20	10
DASC: DASC	30	10	30	20	15	10
ASRT: 1 ASRT (no ord)	40	40	40	40	10	5
FAAD: None	0	0	0	0	0	0
1 SEC (no ord)	10	5	20	10	5	1
1 SEC (dummy ord)	10	5	20	10	5	1

FX; WITH MAU; BOTH AIR SUPPORT AND AIR DEFENSE

	DASC				
	PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC: Non-Deployed	5	15	15	15	10
TAOC: Early Warning	30	20	20	40	20
DASC: DASC	40	40	30	35	30
ASRT: 1 ASRT (no ord)	25	10	10	40	10
FAAD: None	0	0	0	0	0
1 SEC (no ord)	15	15	10	30	25
1 SEC (dummy ord)	15	15	10	30	25

FX; WITH MAU; BOTH AIR SUPPORT AND AIR DEFENSE

	ASRT		
	OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC: Non-Deployed	10	10	10
TAOC: Early Warning	40	40	40
DASC: DASC	30	30	20
ASRT: 1 ASRT (no ord)	40	40	40
FAAD: None	0	0	0
1 SEC (no ord)	25	30	10
1 SEC (dummy ord)	25	30	10

FX; WITH MAU; BOTH AIR SUPPORT AND AIR DEFENSE

	FAAD		
	PHASE CTL	ENGAGE	TEAM SUPPT
TACC: Non-Deployed	10	2	0
TAOC: Early Warning	30	40	20
DASC: DASC	30	35	30
ASRT: 1 ASRT (no ord)	25	40	20
FAAD: None	0	0	0
1 SEC (no ord)	40	40	30
1 SEC (dummy ord)	40	40	45

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC:	Non-Deployed	20	25	55	20	35
	Deployed TACC	50	25	55	40	45
TAOC:	Non-Deployed	20	40	20	40	20
	Early Warning	10	20	10	10	20
	Deployed TAOC	22	40	20	60	30
DASC:	Mini	18	20	20	0	15
	DASC	20	20	20	0	15
	DASC + Mini	22	20	20	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	2	5	0	0	5
	2 BTRY (agg air)	2	8	0	0	5
	3 BTRY (agg air)	2	10	0	0	5
	1 BTRY (missiles)	2	5	0	0	5
	2 BTRY (missiles)	2	8	0	0	5
	3 BTRY (missiles)	2	10	0	0	5
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	2	1	0	0	0
	1 ASRT (w/ord)	2	1	0	0	0
	2 ASRT (no ord)	2	2	0	0	0
	2 ASRT (w/ord)	2	2	0	0	0
	3 ASRT (no ord)	2	3	0	0	0
	3 ASRT (w/ord)	2	3	0	0	0
FAAD:	None	0	0	0	0	0
	1 SECTION (agg air; no ord)	2	2	0	0	5
	1 SECTION (agg air; dummy ord)	2	2	0	0	5
	1 PLATOON (agg air; no ord)	2	2	0	0	5
	1 PLATOON (agg air; dummy ord)	2	2	0	0	5
	1 PLATOON (missiles; no ord)	2	2	0	0	5
	2 PLATOONS (agg air; no ord)	2	2	0	0	5
	2 PLATOONS (agg air; dummy ord)	2	2	0	0	5
	2 PLATOONS (missiles; no ord)	2	2	0	0	5

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	6	17	20	20
	Deployed TACC	12	3	6	17	20	25
TAOC:	Non-Deployed	10	10	30	25	40	40
	Early Warning	35	30	35	27	25	30
	Deployed TAOC	50	40	40	30	45	50
DASC:	Mini	11	7	3	13	18	15
	DASC	11	7	3	13	20	15
	DASC + Mini	12	7	3	15	22	20
LAAM:	None	0	0	0	0	0	0
	1 BTRY (agg air)	10	25	30	25	3	5
	2 BTRY (agg air)	13	35	35	27	3	5
	3 BTRY (agg air)	16	40	40	30	3	5
	1 BTRY (missiles)	10	25	30	25	3	5
	2 BTRY (missiles)	13	35	35	27	3	5
	3 BTRY (missiles)	16	40	40	30	3	5
ASRT:	None	0	0	0	0	0	0
	1 ASRT (no ord)	1	1	1	2	3	0
	1 ASRT (w/ord)	1	1	1	2	3	0
	2 ASRT (no ord)	2	2	1	2	6	0
	2 ASRT (w/ord)	2	2	1	2	6	0
	3 ASRT (no ord)	3	3	1	2	8	0
	3 ASRT (w/ord)	3	3	1	2	8	0
FAAD:	None	0	0	0	0	0	0
	1 SECTION (agg air; no ord)	3	3	3	1	1	0
	1 SECTION (agg air; dummy ord)	3	3	3	1	1	0
	1 PLATOON (agg air; no ord)	5	5	10	3	1	0
	1 PLATOON (agg air; dummy ord)	5	5	10	3	1	0
	1 PLATOON (missiles; no ord)	5	5	10	3	1	0
	2 PLATOONS (agg air; no ord)	7	7	10	6	2	0
	2 PLATOONS (agg air; w/ord)	7	7	10	6	2	0
	2 PLATOONS (missiles; no ord)	7	7	10	6	2	0

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		DASC			
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	25	17	10	25
	Deployed TACC	15	30	22	10	25
TAOC:	Non-Deployed	10	10	7	20	5
	Early Warning	10	10	7	10	5
	Deployed TAOC	15	10	7	20	5
DASC:	Mini	25	28	18	30	22
	DASC	30	30	20	30	22
	DASC + Mini	35	35	22	30	25
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	3	0	0	10	1
	2 BTRY (agg air)	3	0	0	12	1
	3 BTRY (agg air)	3	0	0	14	1
	1 BTRY (missiles)	3	0	0	0	1
	2 BTRY (missiles)	3	0	0	0	1
	3 BTRY (missiles)	3	0	0	0	1
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	5	3	5	1	10
	1 ASRT (w/ord)	5	3	5	1	10
	2 ASRT (no ord)	5	6	10	1	15
	2 ASRT (w/ord)	5	6	10	1	15
	3 ASRT (no ord)	5	9	15	1	20
	3 ASRT (w/ord)	5	9	15	1	20
FAAD:	None	0	0	0	0	0
	1 SECTION (agg air; no ord)	6	1	1	5	1
	1 SECTION (agg air; dummy ord)	6	1	1	5	1
	1 PLATOON (agg air; no ord)	10	1	1	10	1
	1 PLATOON (agg air; dummy ord)	10	1	1	10	1
	1 PLATOON (missiles; no ord)	10	1	1	0	1
	2 PLATOONS (agg air; no ord)	12	1	1	15	1
	2 PLATOONS (agg air; dummy ord)	12	1	1	15	1
	2 PLATOONS (missiles; no ord)	12	1	1	0	1

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	5	5
	Deployed TACC	0	5	5
TAOC:	Non-Deployed	30	25	30
	Early Warning	15	10	15
	Deployed TAOC	30	30	30
DASC:	Mini	0	0	0
	DASC	0	0	0
	DASC + Mini	0	0	0
LAAM:	None	0	0	0
	1 BTRY (agg air)	40	25	30
	2 BTRY (agg air)	50	30	45
	3 BTRY (agg air)	60	35	60
	1 BTRY (missiles)	40	45	0
	2 BTRY (missiles)	50	50	0
	3 BTRY (missiles)	60	55	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
	2 ASRT (no ord)	0	0	0
	2 ASRT (w/ord)	0	0	0
	3 ASRT (no ord)	0	0	0
	3 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 SECTION (agg air; no ord)	3	5	5
	1 SECTION (agg air; dummy ord)	3	5	5
	1 PLATOON (agg air; no ord)	5	10	5
	1 PLATOON (agg air; dummy ord)	5	10	5
	1 PLATOON (missiles; no ord)	5	10	5
	2 PLATOONS (agg air; no ord)	10	10	5
	2 PLATOONS (agg air; dummy ord)	10	10	5
	2 PLATOONS (missiles; no ord)	10	10	5

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	Deployed TACC	0	0	0
TAOC:	Non-Deployed	5	10	0
	Early Warning	5	10	0
	Deployed TAOC	5	10	0
DASC:	Mini	15	10	0
	DASC	15	10	0
	DASC + Mini	20	15	0
LAAM:	None	0	0	0
	1 BTRY (agg air)	0	0	0
	2 BTRY (agg air)	0	0	0
	3 BTRY (agg air)	0	0	0
	1 BTRY (missiles)	0	0	0
	2 BTRY (missiles)	0	0	0
	3 BTRY (missiles)	0	0	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	30	30	15
	1 ASRT (w/ord)	35	35	45
	2 ASRT (no ord)	45	50	26
	2 ASRT (w/ord)	60	55	80
	3 ASRT (no ord)	50	60	32
	3 ASRT (w/ord)	75	65	96
FAAD:	None	0	0	0
	1 SECTION (agg air; no ord)	0	0	0
	1 SECTION (agg air; dummy ord)	0	0	0
	1 PLATOON (agg air; no ord)	0	0	0
	1 PLATOON (agg air; dummy ord)	0	0	0
	1 PLATOON (missiles; no ord)	0	0	0
	2 PLATOONS (agg air; no ord)	0	0	0
	2 PLATOONS (agg air; dummy ord)	0	0	0
	2 PLATOONS (missiles; no ord)	0	0	0

FX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

		FAAD		
		PHASE CTL	ENGAGE	TEAM SUPPT
TACC:	Non-Deployed	5	2	0
	Deployed TACC	5	2	0
TAOC:	Non-Deployed	10	5	0
	Early Warning	5	2	0
	Deployed TAOC	10	5	0
DASC:	Mini	5	3	7
	DASC	7	5	10
	DASC + Mini	7	5	10
LAAM:	None	0	0	0
	1 BTRY (agg air)	5	9	0
	2 BTRY (agg air)	7	11	0
	3 BTRY (agg air)	9	13	0
	1 BTRY (missiles)	5	9	0
	2 BTRY (missiles)	7	11	0
	3 BTRY (missiles)	9	13	0
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
	1 ASRT (w/ord)	0	0	0
	2 ASRT (no ord)	0	0	0
	2 ASRT (w/ord)	0	0	0
	3 ASRT (no ord)	0	0	0
	3 ASRT (w/ord)	0	0	0
FAAD:	None	0	0	0
	1 SECTION (agg air; no ord)	15	20	5
	1 SECTION (agg air; dummy ord)	15	25	10
	1 PLATOON (agg air; no ord)	35	35	30
	1 PLATOON (agg air; dummy ord)	35	45	40
	1 PLATOON (missiles; no agg air)	35	55	45
	2 PLATOONS (agg air; no ord)	45	45	45
	2 PLATOONS (agg air; dummy ord)	45	55	60
	2 PLATOONS (missiles; no agg air)	45	70	65

FX; WITH MAB; AIR SUPPORT ONLY

	TACC				
	PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C²
TACC: Non-Deployed	20	15	25	20	35
TAOC: Non-Deployed	20	14	10	25	15
Early Warning	10	12	5	5	15
DASC: Mini	20	20	23	0	20
DASC	20	20	23	0	20
ASRT: None	0	0	0	0	0
1 ASRT (no ord)	2	1	0	0	0
FAAD: None	0	0	0	0	0
1 PLATOON (no ord)	2	1	0	0	5
1 PLATOON (dummy ord)	2	1	0	0	5
1 SECTION (no ord)	2	1	0	0	5
1 SECTION (dummy)	2	1	0	0	5

FX; WITH MAB; AIR SUPPORT ONLY

	TAOC					
	PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC: Non-Deployed	10	3	0	17	10	12
TAOC: Non-Deployed	10	10	0	25	20	25
Early Warning	35	30	0	27	10	20
DASC: Mini	11	7	0	13	18	20
DASC	11	7	0	13	20	20
ASRT: None	0	0	0	0	0	0
1 ASRT (no ord)	1	1	0	2	3	0
FAAD: None	0	0	0	0	0	0
1 PLATOON (no ord)	5	5	0	1	1	0
1 PLATOON (dummy ord)	5	5	0	1	1	0
1 SECTION (no ord)	3	3	0	1	1	0
1 SECTION (dummy)	3	3	0	1	1	0

FX; WITH MAB; AIR SUPPORT ONLY

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	25	20	5	20
TAOC:	Non-Deployed	10	6	5	5	5
	Early Warning	10	6	5	5	5
DASC:	Mini	25	28	28	20	27
	DASC	30	35	30	20	27
ASRT:	None	0	0	0	0	0
	1 ASRT (no ord)	5	3	5	1	15
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord)	10	1	1	10	1
	1 PLATOON (dummy ord)	10	1	1	10	1
	1 SECTION (no ord)	3	1	1	5	1
	1 SECTION (dummy ord)	3	1	1	5	1

FX; WITH MAB; AIR SUPPORT ONLY

	ASRT		
	OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC: Non-Deployed	0	0	0
TAOC: Non-Deployed	5	8	0
Early Warning	5	8	0
DASC: Mini	15	20	0
DASC	15	25	0
ASRT: None	0	0	0
1 ASRT (no ord)	30	30	15
FAAD: None	0	0	0
1 PLATOON (no ord)	0	0	0
1 PLATOON (dummy ord)	0	0	0
1 SECTION (no ord)	0	0	0
1 SECTION (dummy ord)	0	0	0

FX; WITH MAB; AIR SUPPORT ONLY

		FAAD		
		PHASE CTL	ENGAGE	TEAM SUPPT
TACC:	Non-Deployed	3	1	0
TAOC:	Non-Deployed	6	2	0
	Early Warning	3	1	0
DASC:	Mini	6	3	8
	DASC	8	4	10
ASRT:	None	0	0	0
	1 ASRT (no ord)	0	0	0
FAAD:	None	0	0	0
	1 PLATOON (no ord)	30	20	25
	1 PLATOON (dummy ord)	30	25	35
	1 SECTION (no ord)	15	12	12
	1 SECTION (dummy ord)	15	15	17

FX; WITH MAU; AIR SUPPORT ONLY

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C²
TACC:	Non-Deployed	15	11	15	0	15
	Deployed	5	5	5	0	5
TAOC:	Non-Deployed	15	15	5	0	15
DASC:	Mini	15	15	15	0	15
FAAD:	None	0	0	0	0	0
	1 SECTION (agg air; no ord)	1	1	0	0	2
	1 SECTION (agg air; dummy ord)	1	1	0	0	2

FX; WITH MAU; AIR SUPPORT ONLY

	TAOC					
	PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC: Non-Deployed	10	2	0	10	5	6
Deployed	5	1	0	5	1	2
TAOC: Non-Deployed	10	5	0	15	10	10
DASC: Mini	11	5	0	5	9	10
FAAD: None	0	0	0	0	0	0
1 SECTION (agg air; no ord)	1	1	0	0	1	0
1 SECTION (agg air; dummy ord)	1	1	0	0	1	0

FX; WITH MAU; AIR SUPPORT ONLY

	DASC				
	PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC: Non-Deployed	5	15	15	2	10
Deployed	1	5	5	1	3
TAOC: Non-Deployed	5	3	3	2	1
DASC: Mini	10	20	20	10	15
FAAD: None	0	0	0	0	0
1 SECTION (agg air; no ord)	1	1	1	3	1
1 SECTION (agg air; dummy ord)	1	1	1	3	1

FX; WITH MAU; AIR SUPPORT ONLY

	FAAD		
	PHASE CTL	ENGAGE	TEAM SUPPT
TACC: Non-Deployed	1	1	0
Deployed			
TAOC: Non-Deployed	1	1	0
DASC: Mini	4	2	6
FAAD: None	0	0	0
1 SECTION (agg air; no ord)	10	8	10
1 SECTION (agg air; dummy ord)	10	10	15

FX; AIR ONLY; AIR SUPPORT ONLY

TACC

	PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C²
TACC: Non-Deployed	20	13	40	10	35
Deployed TACC	40	13	40	20	45
TAOC: Non-Deployed	20	20	10	25	15
Early Warning	10	18	5	5	15
DASC: Non-Deployed	15	20	23	0	20
Mini	18	20	23	0	20
DASC	20	20	23	0	20
ASRT: 1 ASRT (no ord)	2	1	0	0	0
1 ASRT (w/ord)	2	1	0	0	0
2 ASRT (no ord)	2	2	0	0	0
2 ASRT (w/ord)	2	2	0	0	0
3 ASRT (no ord)	2	3	0	0	0
3 ASRT (w/ord)	2	3	0	0	0

AD-A107 603 DECISIONS AND DESIGNS INC MCLEAN VA F/G 9/2
TRAINING REQUIREMENTS AND COST EVALUATION SYSTEM (TRACES) FOR M--ETC(U)
NOV 81 J F PATTERSON, L ADELMAN M00027-81-C-0052
UNCLASSIFIED PR-81-26-329 NL

2 OF 2
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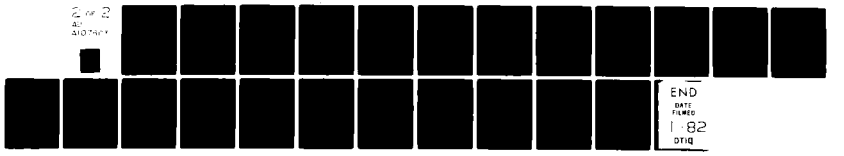

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FX; AIR ONLY; AIR SUPPORT ONLY

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	0	17	10	12
	Deployed TACC	12	3	0	17	10	15
TAOC:	Non-Deployed	10	10	0	25	25	30
	Early Warning	35	30	0	27	15	25
DASC:	Non-Deployed	11	7	0	13	18	20
	Mini	11	7	0	13	18	20
	DASC	11	7	0	13	20	20
ASRT:	1 ASRT (no ord)	1	1	0	2	3	0
	1 ASRT (w/ord)	1	1	0	2	3	0
	2 ASRT (no ord)	1	2	0	2	6	0
	2 ASRT (w/ord)	1	2	0	2	6	0
	3 ASRT (no ord)	1	3	0	2	8	0
	3 ASRT (w/ord)	1	3	0	2	8	0

FX; AIR ONLY; AIR SUPPORT ONLY

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	25	17	5	20
	Deployed TACC	15	30	22	5	20
TAOC:	Non-Deployed	10	6	5	5	5
	Early Warning	10	6	5	5	5
DASC:	Non-Deployed	2	30	20	20	22
	Mini	25	28	20	20	22
	DASC	30	30	22	20	22
ASRT:	1 ASRT (no ord)	5	3	5	1	10
	1 ASRT (w/ord)	5	3	5	1	10
	2 ASRT (no ord)	5	6	10	1	15
	2 ASRT (w/ord)	5	6	10	1	15
	3 ASRT (no ord)	5	9	15	1	20
	3 ASRT (w/ord)	5	9	15	1	20

FX; AIR ONLY; AIR SUPPORT ONLY

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	TACC	0	0	0
TADC:	Non-Deployed	5	5	0
	Early Warning	5	5	0
DASC:	Non-Deployed	15	10	0
	Mini	15	10	0
	DASC	15	10	0
ASRT:	1 ASRT (no ord)	30	30	15
	1 ASRT (w/ord)	35	35	45
	2 ASRT (no ord)	45	50	26
	2 ASRT (w/ord)	60	55	80
	3 ASRT (no ord)	50	60	32
	3 ASRT (w/ord)	75	65	96

FX; AIR ONLY; AIR DEFENSE ONLY

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC:	Non-Deployed	20	20	45	20	35
	Deployed TACC	40	20	45	40	45
TAOC:	Non-Deployed	20	40	20	40	20
	Early Warning	10	20	10	10	20
	Deployed TAOC	22	40	20	60	30
DASC:	Non-Deployed	15	10	15	0	10
	Mini	18	10	15	0	10
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	2	5	0	0	5
	2 BTRY (agg air)	2	8	0	0	5
	3 BTRY (agg air)	2	10	0	0	5
	1 BTRY (missiles)	2	5	0	0	5
	2 BTRY (missiles)	2	8	0	0	5
	3 BTRY (missiles)	2	10	0	0	5
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord; agg air)	2	2	0	0	5
	1 PLATOON (dummy ord)	2	2	0	0	5
	1 PLATOON (missiles)	2	2	0	0	5
	2 PLATOONS (no ord)	2	2	0	0	5
	2 PLATOONS (dummy ord)	2	2	0	0	5
	2 PLATOONS (missiles)	2	2	0	0	5

FX; AIR ONLY; AIR DEFENSE ONLY

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	6	17	15	15
	Deployed TACC	12	3	6	17	15	20
TAOC:	Non-Deployed	10	10	30	25	35	35
	Early Warning	35	30	35	27	20	25
	Deployed TAOC	50	40	40	30	40	45
DASC:	Non-Deployed	11	7	3	13	5	10
	Mini	11	7	3	13	5	5
LAAM:	None	0	0	0	0	0	0
	1 BTRY (agg air)	10	25	30	25	3	5
	2 BTRY (agg air)	13	35	35	27	3	5
	3 BTRY (agg air)	16	40	40	30	3	5
	1 BTRY (missiles)	10	25	30	25	3	5
	2 BTRY (missiles)	13	35	35	27	3	5
	3 BTRY (missiles)	16	40	40	30	3	5
FAAD:	None	0	0	0	0	0	0
	1 PLATOON (no ord; agg air)	5	5	10	3	1	0
	1 PLATOON (dummy ord)	5	5	10	3	1	0
	1 PLATOON (missiles)	5	5	10	3	1	0
	2 PLATOONS (no ord)	7	7	10	6	2	0
	2 PLATOONS (dummy ord)	7	7	10	6	2	0
	2 PLATOONS (missiles)	7	7	10	6	2	0

FX; AIR ONLY; AIR DEFENSE ONLY

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	5	0	0	2	7
	Deployed TACC	10	0	0	2	7
TAOC:	Non-Deployed	5	0	0	3	5
	Early Warning	5	0	0	2	5
	Deployed TACC	10	0	0	3	5
DASC:	Non-Deployed	2	0	0	10	10
	Mini	15	0	0	10	10
LAAM:	None	0	0	0	0	0
	1 BTRY (agg air)	3	0	0	5	1
	2 BTRY (agg air)	3	0	0	6	1
	3 BTRY (agg air)	3	0	0	7	1
	1 BTRY (missiles)	3	0	0	0	1
	2 BTRY (missiles)	3	0	0	0	1
	3 BTRY (missiles)	3	0	0	0	1
FAAD:	None	0	0	0	0	0
	1 PLATOON (no ord; agg air)	5	0	0	10	2
	1 PLATOON (dummy ord)	5	0	0	10	2
	1 PLATOON (missiles)	5	0	0	0	2
	2 PLATOONS (no ord)	6	0	0	15	2
	2 PLATOONS (dummy ord)	6	0	0	15	2
	2 PLATOONS (missiles)	6	0	0	0	2

FX; AIR ONLY; AIR DEFENSE ONLY

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	5	5
	Deployed TACC	0	5	5
TAOC:	Non-Deployed	30	25	30
	Early Warning	15	10	15
	Deployed TACC	30	30	30
DASC:	Non-Deployed	0	0	0
	Mini	0	0	0
LAAM:	None	0	0	0
	1 BTRY (agg. air)	40	25	30
	2 BTRY (agg air)	50	30	45
	3 BTRY (agg air)	60	35	60
	1 BTRY (missiles)	40	45	0
	2 BTRY (missiles)	50	50	0
	3 BTRY (missiles)	60	55	0
FAAD:	None	0	0	0
	1 PLATOON (no ord; agg air)	5	10	5
	1 PLATOON (dummy ord)	5	10	5
	1 PLATOON (missiles)	5	10	5
	2 PLATOONS (no ord)	10	10	5
	2 PLATOONS (dummy ord)	10	10	5
	2 PLATOONS (missiles)	10	10	5

FX; AIR ONLY; AIR DEFENSE ONLY

		FAAD		
		PHASE CTL	ENGAGE	TEAM SUPPT
TACC:	Non-Deployed	5	2	0
	Deployed TACC	5	2	0
TAOC:	Non-Deployed	10	5	0
	Early Warning	5	2	0
	Deployed TACC	10	5	0
DASC:	Non-Deployed	3	2	5
	Mini	5	3	7
LAAM:	None	0	0	0
	1 BTRY (agg air)	5	9	0
	2 BTRY (agg air)	7	11	0
	3 BTRY (agg air)	9	13	0
	1 BTRY (missiles)	5	9	0
	2 BTRY (missiles)	7	11	0
	3 BTRY (missiles)	9	13	0
FAAD:	None	0	0	0
	1 PLATOON (no ord; agg air)	35	27	30
	1 PLATOON (dummy ord)	35	35	40
	1 PLATOON (missiles)	35	42	45
	2 PLATOONS (no ord)	45	35	45
	2 PLATOONS (dummy ord)	45	42	60
	2 PLATOONS (missiles)	45	55	65

CPX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC:	Non-Deployed	20	25	25	20	35
	Deployed	40	25	25	40	45
TAOC:	Non-Deployed	20	40	15	40	20
DASC:	Mini DASC	20	20	15	0	15
	DASC	20	20	15	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	1	2	0	0	5
	2 BTRY (non-deployed; no ord)	1	2	0	0	5
	3 BTRY (non-deployed; no ord)	1	2	0	0	5
ASRT:	None	0	0	0	0	0
	1 ASRT (non-deployed)	1	1	0	0	0

CPX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	3	10	10	20
	Deployed	0	3	3	10	10	25
TAOC:	Non-Deployed	10	8	15	12	20	30
DASC:	Mini DASC	11	3	1	8	9	12
	DASC	11	3	1	8	10	12
LAAM:	None	0	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	10	0	15	10	1	5
	2 BTRY (non-deployed; no ord)	13	0	20	12	1	5
	3 BTRY (non-deployed; no ord)	16	0	25	15	1	5
ASRT:	None	0	0	0	0	0	0
	1 ASRT (non-deployed)	1	0	1	2	1	0

CPX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	10	7	5	18
	Deployed	15	13	9	5	18
TAOC:	Non-Deployed	10	10	3	10	2
DASC:	Mini DASC	30	15	15	20	20
	DASC	40	20	20	20	20
LAAM:	None	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	2	0	0	2	1
	2 BTRY (non-deployed; no ord)	2	0	0	3	1
	3 BTRY (non-deployed; no ord)	2	0	0	4	1
ASRT:	None	0	0	0	0	0
	1 ASRT (non-deployed)	5	2	5	1	10

CPX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	2	2
	Deployed	0	2	2
TAOC:	Non-Deployed	10	10	10
DASC:	Mini DASC	0	0	0
	DASC	0	0	0
LAAM:	None	0	0	0
	1 BTRY (non-deployed; no ord)	5	5	8
	2 BTRY (non-deployed; no ord)	10	10	12
	3 BTRY (non-deployed; no ord)	15	15	16
ASRT:	None	0	0	0
	1 ASRT (non-deployed)	0	0	0

CPX; WITH MAF; BOTH AIR SUPPORT AND AIR DEFENSE

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	Deployed	0	0	0
TAOC:	Non-Deployed	2	2	0
DASC:	Mini DASC	7	5	0
	DASC	7	7	0
LAAM:	None	0	0	0
	1 BTRY (non-deployed; no ord)	0	0	0
	2 BTRY (non-deployed; no ord)	0	0	0
	3 BTRY (non-deployed; no ord)	0	0	0
ASRT:	None	0	0	0
	1 ASRT (non-deployed)	5	5	0

CPX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		TACC				
		PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C²
TACC:	Non-Deployed	20	22	20	20	35
	Deployed	40	22	20	40	45
TAOC:	Non-Deployed	20	40	15	40	20
DASC:	Mini DASC	20	20	15	0	15
	DASC	20	20	15	0	15
LAAM:	None	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	1	2	0	0	5
	2 BTRY (non-deployed; no ord)	1	2	0	0	5
	3 BTRY (non-deployed; no ord)	1	2	0	0	5
ASRT:	None	0	0	0	0	0
	1 ASRT (non-deployed)	1	1	0	0	0

CPX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		TAOC					
		PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC:	Non-Deployed	10	3	3	10	7	20
	Deployed		3	3	10	7	15
TAOC:	Non-Deployed	10	8	15	12	17	30
DASC:	Mini DASC	11	2	1	8	9	12
	DASC	11	2	1	8	10	12
LAAM:	None	0	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	10	0	15	10	1	5
	2 BTRY (non-deployed; no ord)	13	0	20	12	1	5
	3 BTRY (non-deployed; no ord)	16	0	25	15	1	5
ASRT:	None	0	0	0	0	0	0
	1 ASRT (non-deployed)	1	0	1	2	1	0

CPX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		DASC				
		PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC:	Non-Deployed	10	8	5	5	16
	Deployed	15	9	7	5	16
TAOC:	Non-Deployed	10	8	2	10	2
DASC:	Mini DASC	25	12	11	15	18
	DASC	35	16	14	15	18
LAAM:	None	0	0	0	0	0
	1 BTRY (non-deployed; no ord)	2	0	0	2	1
	2 BTRY (non-deployed; no ord)	2	0	0	3	1
	3 BTRY (non-deployed; no ord)	2	0	0	4	1
ASRT:	None	0	0	0	0	0
	1 ASRT (non-deployed)	5	2	5	1	10

CPX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		LAAM		
		SETUP	ENGAGE	ECM
TACC:	Non-Deployed	0	1	2
	Deployed	0	1	2
TAOC:	Non-Deployed	10	6	10
DASC:	Mini DASC	0	0	0
	DASC	0	0	0
LAAM:	None	0	0	0
	1 BTRY (non-deployed; no ord)	5	4	8
	2 BTRY (non-deployed; no ord)	10	8	12
	3 BTRY (non-deployed; no ord)	15	12	16
ASRT:	None	0	0	0
	1 ASRT (non-deployed)	0	0	0

CPX; WITH MAB; BOTH AIR SUPPORT AND AIR DEFENSE

		ASRT		
		OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC:	Non-Deployed	0	0	0
	Deployed	0	0	0
TAOC:	Non-Deployed	2	2	0
DASC:	Mini DASC	7	5	0
	DASC	7	7	0
LAAM:	None	0	0	0
	1 BTRY (non-deployed; no ord)	0	0	0
	2 BTRY (non-deployed; no ord)	0	0	0
	3 BTRY (non-deployed; no ord)	0	0	0
ASRT:	None	0	0	0
	1 ASRT (non-deployed)	5	5	0

CPX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

	TACC				
	PHASE CTL	DSPLY	MNG. A/C	EXT. AG.	SUCC. OF C^2
TACC: Non-Deployed	20	25	25	20	35
TAOC: Non-Deployed (no sorties)	20	40	15	40	20
DASC: Non-Deployed (no sorties)	15	20	15	0	15
Mini DASC	18	20	15	0	15
LAAM: None	0	0	0	0	0
1 BTRY (non-deployed)	1	2	0	0	5
2 BTRY (non-deployed)	1	2	0	0	5
3 BTRY (non-deployed)	1	2	0	0	5
ASRT: None	0	0	0	0	0
1 ASRT (non-deployed)	1	1	0	0	0

CPX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

	TAOC					
	PHASE ASHORE	RADAR SURV	ENGAGE CTL	EMIS CONT	AIRSPC MGMT	ALT TACC
TACC: Non-Deployed	10	3	3	10	10	20
TAOC: Non-Deployed (no sorties)	10	8	15	12	20	30
DASC: Non-Deployed (no sorties)	11	3	1	8	9	12
Mini DASC	11	3	1	8	9	12
LAAM: None	0	0	0	0	0	0
1 BTRY (non-deployed)	10	0	15	10	1	5
2 BTRY (non-deployed)	13	0	20	12	1	5
3 BTRY (non-deployed)	16	0	25	15	1	5
ASRT: None	0	0	0	0	0	0
1 ASRT (non-deployed)	1	0	1	2	1	0

CPX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

	DASC				
	PHASE CTL	PRE-PLAN	IMMED.	AIR DEF.	RPRTS
TACC: Non-Deployed	10	8	4	5	16
TAOC: Non-Deployed (no sorties)	10	10	3	10	2
DASC: Non-Deployed (no sorties)	10	10	9	15	14
Mini DASC	20	10	9	15	14
LAAM: None	0	0	0	0	0
1 BTRY (non-deployed)	2	0	0	2	1
2 BTRY (non-deployed)	2	0	0	3	1
3 BTRY (non-deployed)	2	0	0	4	1
ASRT: None	0	0	0	0	0
1 ASRT (non-deployed)	5	2	5	1	5

CPX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

	LAAM		
	SETUP	ENGAGE	ECM
TACC: Non-Deployed	0	2	2
TAOC: Non-Deployed (no sorties)	10	10	10
DASC: Non-Deployed (no sorties)	0	0	0
Mini DASC	0	0	0
LAAM: None	0	0	0
1 BTRY (non-deployed)	5	5	8
2 BTRY (non-deployed)	10	10	12
3 BTRY (non-deployed)	15	15	16
ASRT: None	0	0	0
1 ASRT (non-deployed)	0	0	0

CPX; AIR ONLY; BOTH AIR SUPPORT AND AIR DEFENSE

	ASRT		
	OPS PREP	PRECISE BOMBING CONTROL	A/C POSITIONING
TACC: Non-Deployed	0	0	0
TACC: Non-Deployed (no sorties)	2	2	0
DASC: Non-Deployed (no sorties)	7	4	0
Mini DASC	7	4	0
LAAM: None	0	0	0
1 BTRY (non-deployed)	0	0	0
2 BTRY (non-deployed)	0	0	0
3 BTRY (non-deployed)	0	0	0
ASRT: None	0	0	0
1 ASRT (non-deployed)	5	5	0


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